# Application form for an AXA Chair

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| AXA Chair's title | **AXA Chair on Sand and Dust Storms** |
| Chair funding scheme | X **AXA Chair position**<br>☐ AXA Successional Chair program |
| Duration of the agreement<br>(5 to 30 years) | **20 years** |
| Institution hosting the AXA Chair | **Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC-CNS)** |
| Annual financial flow expected from AXA fundings<br>(from €60.000 to €120.000 p.a.) | **€120.000** |

**A complete application package should include:**

X The application form duly completed

X The candidate's letter of intent

X A detailed CV of prospective Chair Holder including publications. Regarding the latter, please provide a list of the 10 with greater impact and the 10 most recent ones.

X Two letters of recommendation, one of them being a letter of support by the president/rector of the institution.

☐ Video recording of a presentation by the prospective Chair Holder of his/her research *(optional – the recording need not be longer than 3mn)* to be sent in .avi or .flv format to Isabelle DELAPORTE, AXA Research Fund - 40, rue du Colisée, 75008 Paris, FRANCE

Summary of the AXA Chair's objectives and program (max. 200 words)

Sand and Dust Storms (SDS) are extreme meteorological phenomena that generate significant amounts of airborne mineral dust particles. SDS represent a serious hazard for life, health, property, environment and economy in many countries, particularly in some of the least developed ones, and play a significant role in different aspects of weather, climate and atmospheric chemistry. The aim of the AXA Chair on SDS at the Barcelona Supercomputing Center will be to enable new knowledge, cutting-edge technology and capabilities to better understand, predict SDS and manage their effects and impacts across multiple spatial and temporal scales for the benefit of society.

The AXA Chair holder candidate, Dr. Carlos Pérez García-Pando, will lead an ambitious, comprehensive and long-term program that combines fundamental research, operational forecasting and impact research, with the much-needed development of user-oriented products, services and capabilities, all under one roof. This unprecedented program will improve our understanding of SDS and their variability; quantify dust effects upon weather, climate, atmospheric chemistry and ocean biogeochemistry; develop and distribute skillful SDS short- and medium-range forecasts and long-range dust predictions and projections; assess SDS impacts upon key sectors of society and economy; and promote capacity building, technology transfer, dissemination and public engagement.

# 1. Description

## The importance of Sand and Dust Storms in the Earth System

Sand and Dust Storms (SDS) are extreme meteorological phenomena, common in arid and semi-arid regions that generate disproportionate amounts of airborne mineral dust particles. Once emitted, dust particles reduce visibility to near zero in source regions and are regularly carried over distances of thousands of kilometres before being deposited to land and ocean waters. Dust makes the largest contribution to the global aerosol mass load (Textor *et al*., 2006) and is the dominating component of atmospheric aerosol over large areas of the Earth **(Figure 1)**. The major sources of contemporary dust are found in the Northern Hemisphere, in the so-called "dust belt", extending from the eastern subtropical Atlantic eastwards through the Sahara Desert to Arabia and southwest Asia, and to a lesser degree in the Australian, American and South African deserts (Prospero *et al*., 2002). Although natural deserts dominate dust production, anthropogenic sources resulting from changes in land-use are estimated to contribute about 25% of the global emission and can dominate dust production regionally (Ginoux *et al*., 2012).

SDS represent a serious hazard for life, health, property, environment and economy in many countries, particularly in some of the least developed countries in North Africa and the Middle East. SDS severely compromise air quality, increasing the incidence of respiratory disease, eye infections, and cardiovascular mortality (Morman and Plumlee, 2013); and have been associated to deadly epidemics of meningococcal meningitis in the African Sahel (Pérez García-Pando *et al*., 2014a; 2014b) and to coccidioidomycosis ('valley fever') in North America (e.g., Kirkland *et al*., 1996). Dust is a carrier of pathogenic microorganisms such as fungal spores, bacteria and viruses (e.g., Gonzalez-Martin *et al*., 2014). Intense outbreaks can force the closing of roads and airports due to poor visibility, and strongly affect commercial solar energy production systems by reducing solar insolation (e.g. Schroedter-Homscheidt *et al*., 2013). Agricultural impacts of SDS include losses of crop and livestock (Stefanski and Sivakumar, 2009).

Dust also plays a significant role in different aspects of weather, climate and atmospheric chemistry. It is unique among aerosol phenomena, as it is both an indicator of past climate variations and an integral contributor to climate change (Okin *et al*., 2011), on time scales ranging from interannual to decadal as well as glacial to geologic (e.g., Rea, 1994; Biscaye *et al*., 1997; Prospero and Lamb, 2003, Mahowald *et al*., 2010). Dust perturbs the energy and water cycles of the atmosphere by direct radiative forcing (e.g., Miller and Tegen, 1998; Pérez *at al*., 2006a; Miller *et al*., 2014a) and by altering cloud evolution and reflectivity (e.g., DeMott *et al*., 2003; Navea *et al*., 2010). Dust particles with coatings of sulfates and nitrates influences the mass of the pure form of these aerosol species by competing for chemical precursors including ozone (e.g., Bauer and Koch, 2005). Dust delivers iron and phosphorus to land and ocean ecosystems, increasing photosynthesis and biological productivity, while reducing the atmospheric concentration of carbon dioxide (e.g. Swap *et al*., 1992; Jickells *et al*., 2005).

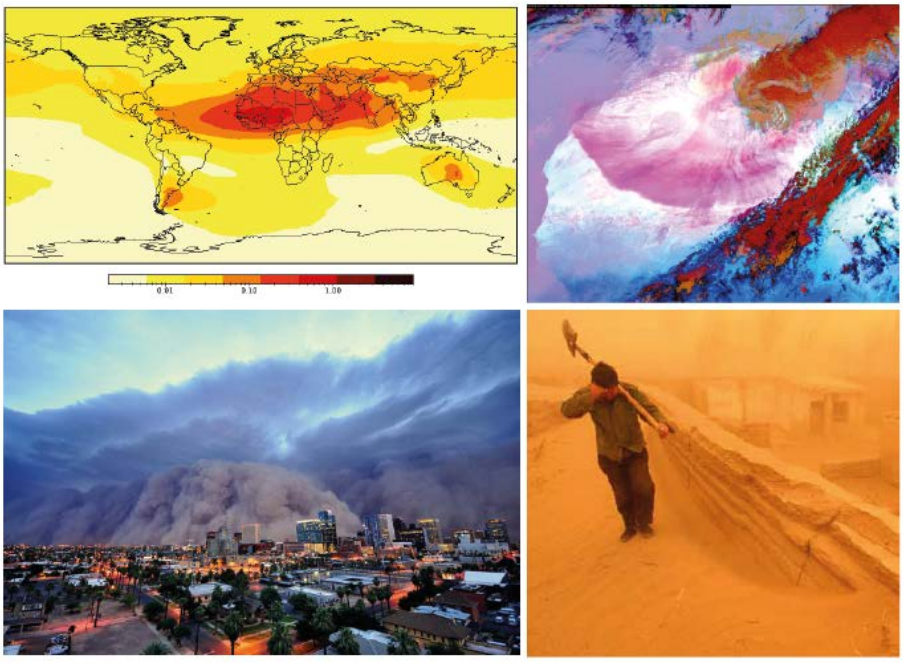

**Figure 1.**

*Left:* Global distribution of the average annual dust optical depth at 550 nm estimated with the NMMB/BSC-CTM model.

*Right:* On March 2004 cold air swept across the Sahara generating a continental scale dust storm (pink colour) - courtesy EUMETSAT.

*Left:* A dust storm referred to as 'haboob' hiting Phoenix.

*Right:* A farmer walks amid a heavy dust storm in Minqin County, northwest of China's Gansu Province. The storm covered one-eighth of China during several days - courtesy Len Barrie and Slobodan Nickovic.



AXA Research Fund

## An AXA Chair on Sand and Dust Storms based at the BSC-CNS

The creation of an **AXA Chair on Sand and Dust Storms** at the Barcelona Supercomputing Center (BSC-CNS) would enable new knowledge, cutting-edge technology and capabilities to better understand and predict SDS and their effects, and manage their impacts across multiple spatial and temporal scales for the benefit of society. This will be achieved through a comprehensive long-term program integrating fundamental research, operational forecasting, impact research, user-oriented products and services, technology transfer, capacity building and knowledge dissemination.

In the last years, there has been an increasing recognition of the crucial role of dust on weather, climate and ecosystems along with the important adverse impacts of SDS upon life, health, property, economy and other strategic areas. In a survey conducted by the World Meteorological Organization (WMO) in 2005, more than forty WMO member states formally expressed their concerns on SDS and their interest on building capacities for SDS warning advisory and assessment. In 2007, WMO officially endorsed the launch of the Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS), whose mission is to enhance the ability of countries to deliver timely and quality SDS forecasts, observations, information and knowledge to users through an international partnership of research and operational communities. To achieve this mission, WMO designated Regional Nodes consisting of a network of research and operational partners that are supported and coordinated by a Regional Center. The BSC-CNS and the Spanish Meteorological Agency (AEMET) were designated to host the WMO Regional Center for Northern Africa, Middle East and Europe (http://sds-was.aemet.es/). More recently, in view of the demand of many national meteorological services and the achievements of the SDS-WAS RC, the 65$^{th}$ Session of the WMO Executive Council designated the same consortium, formed by BSC-CNS and AEMET, to create in Barcelona the first Regional Specialized Meteorological Center with activity specialization on Atmospheric Sand and Dust Forecast, known as the Barcelona Dust Forecast Center (BDFC). The Center was created in February 2014 (http://dust.aemet.es/) and its mandate is to generate and distribute operational dust forecasts 365 days a year.

***By creating an AXA Chair on SDS at the BSC-CNS, the AXA Research Fund would not only support the mission and ensure the existence and long-term strategy of the two WMO SDS Regional Centers based at the BSC-CNS, but also would largely expand their current scope and relevance.***

Understanding, managing and mitigating SDS risks and effects requires fundamental and cross-disciplinary knowledge underpinned by state-of-the-art scientific research, the availability of reliable information on SDS trends and current conditions, the provision of skillful forecasts and projections tailored to a diversity of users, and the capacity to use the information effectively. At present, all these requirements are confronted by major challenges, including:

- Poor understanding of some key physical processes controlling dust aerosols and their effects at multiple spatial and temporal scales,
- Lack of reliable dust information in many countries affected by SDS,
- Large uncertainties of current SDS forecasts on time scales from days to a week,
- Severe lack of knowledge and capabilities for long-range dust prediction (from months to decades),
- Limited integration of dust information and forecasts into practice and policy.

***The AXA Chair holder candidate Dr Carlos Pérez García-Pando, who is an emerging leading expert in Sand and Dust Storm modeling and their effects, has designed an ambitious long-term program to tackle these formidable challenges. Through the program, he will comprehensively align the research groups of the Earth Sciences Department (BSC-ES), the two WMO Regional Centers, the Support Group of the BSC-CNS, and a long list of world-reknown partners and collaborating institutions, towards making a leap forward in the way this topic impacts society. Recruiting this young excellent researcher from NASA with the expertise and the impulse needed to accomplish such an ambitious and cross-disciplinary plan would only be possible with AXA's long-term support.***

Dr Pérez García-Pando initiated the SDS research line at the BSC-CNS in 2006. The development of the NMMB/BSC-CTM, the forecast model he conceived and initially developed, is key to the success of the SDS program at the BSC-CNS. His work and leadership at the BSC-CNS led to an internationally recognized dust modeling group and played a seminal role for the establishment and successful operation of the WMO Regional Centers. In 2009, Dr Pérez García-Pando moved to the US where he has held research positions at the National Centers for Environmenal Prediction (NOAA/NCEP), focusing on short- and medium-range dust and weather forecasting; the International Research Institute for Climate and Society (IRI), focusing on the impacts of climate and dust aerosols upon infectious diseases in North Africa; and the NASA Goddard Institute for Space studies (NASA GISS) and Columbia University, focusing on the mineral and chemical composition of dust aerosols and their effects at longer (climate) time scales. This highly qualified and broad expertise in the field makes him a unique asset to lead the ambitious and cross-disciplinary activities of the AXA Chair program.

The emerging new structure and expertise within the BSC-ES, the hosting department, is of crucial importance for Dr Pérez García-Pando's success on achieving the goals described below. The BSC-CNS is strengthening the BSC-ES to become a major player in the provision of solutions and adaptation measures to increase society's resilience to climate and environmental change and reduce its impacts and costs. In 2014, the Center recruited the ICREA Professor Francisco Doblas-Reyes as new director of the BSC-ES. Dr Doblas-Reyes is a first-rate researcher, who also holds the direction of the Climate Forecast Unit at the Institut Català de Ciències del Clima (IC3-CFU). He has expanded the scope of the BSC-ES by merging the original research group focusing on the development of atmospheric and chemical transport models for regional and global forecasting, with the IC3-CFU, which is one of the most active and well-known research groups on climate prediction and services in Europe. This merging, though challenging, is creating a more efficient and competitive department that holds a sufficient critical mass to compete with the top international research groups in Earth system modeling. The BSC-ES is now organized around four closely interacting groups (*Atmospheric Composition, Climate Prediction, Computational Earth Sciences, and Earth Sciences Services*), comprising 45 employees, including scientists, and technical and support staff. A more detailed description of the BSC-CNS and the four research groups within the BSC-ES is presented in Section 7 of this application.

The long-term goals of the four research groups are perfectly aligned towards making the AXA Chair a unique and successful initiative. The potential synergies between the four research groups in the field of SDS offers a unique opportunity for Dr Pérez García-Pando to implement these demanding goals and prove that excellent research in the field of SDS can go hand in hand with a much-needed socioeconomic impact. The level of commitment and expertise of Dr Pérez García-Pando and his team at the BSC-ES is high enough to make this ambitious plan a reality, as reflected by their outstanding research, international collaborations and number of successful grants (see Sections 2, 7 and 8).

The SDS scientific community is large and diverse. Dr Pérez García-Pando and the BSC-ES, in its role as WMO Regional Center, have a long list of world-leading collaborators in different aspects of the SDS problem along with partnerships with potential end users of the developed SDS products. In this sense, the BSC-CNS will be particularly well positioned to utilize SDS advances not only developed in-house but also at other collaborating research centers and laboratories worldwide for the benefit of society.

***By funding the Chair on SDS, AXA will place the BSC-CNS at the forefront of programs that integrate fundamental SDS research with assessment and implementation of SDS risk assessment and mitigation strategies. In twenty years, the vision of the program is to effectively integrate SDS knowledge and technology into policy and practice.***

## Sand and Dust Storm Models and Forecasts

This section presents the two main models that will be used and developed to advance SDS research, forecasting and services, and accomplish the goals of the AXA Chair program described in the following section. This information provides the reader with the baseline modeling context while allowing a better understanding of the description of the research program.

- The **NMMB/BSC-CTM** is a multi-scale non-hydrostatic atmospheric chemistry and weather prediction system comprised of an atmospheric model (the Non-Hydrostatic Multi-scale Model, NMMB) developed at NOAA/NCEP (Janjic, 2005; Janjic and Black, 2007; Janjic *et al*., 2011; Janjic and Gall, 2012) and a Chemical Transport Model (BSC-CTM) conceived by Dr Pérez García-Pando and further developed by the Atmospheric Composition Group of the BSC-ES in close collaboration with NOAA/NCEP and other partners, including the NASA Goddard Institute for Space Studies (NASA GISS) and the University of California, Irvine (UCI) (Pérez *et al*., 2011; Haustein *et al*., 2012; Jorba *et al*., 2012; Spada *et al*., 2013; Badia and Jorba, 2014). This state-of-the-art model is designed to be efficient, flexible, and extendible. It contains advanced physics, chemistry and aerosol packages, and has the unique ability to be configured as a global model or as a very high-resolution regional model, both with embedded 1- or 2-way static or moving nests. Seven types of tropospheric aerosols are included: sea salt, dust, black carbon, organic matter (both primary and secondary), sulfate, nitrate and volcanic ash. The two primary natural aerosols, sea salt and dust, have their sources linked to prognostic model variables. The model also includes detailed gas-phase chemistry with 51 chemical species and 156 reactions. Physical processes include dry deposition, gravitational settling, wet deposition (including rainout and washout in and below the clouds), and radiative interaction allowing feedbacks between aerosols and the atmosphere. The model's dust component produces forecasts at the SDS-WAS Regional Center for a regional domain comprising Northern Africa, Middle East and Europe, where it is combined with other dust model forecasts from collaborating institutions (ECMWF, SEEVCC, Met Office, NASA, NCEP, EMA and CNR) and evaluated in near-real time. The model also runs operationally (7 days a week, 365 days a year) at the BDFC with a horizontal resolution of 10 km for the same region. At the global scale, the model contributes to the International Cooperative for Aerosol Prediction (ICAP) Multi Model Ensemble (Sessions *et al*., 2014), which is built from the following systems in addition to the NMMB/BSC-

CTM: ECMWF MACC, JMA MASINGAR, NASA GSFC/GMAO, FNMOC/NRL NAAPS, NOAA NGAC, and Met Office Unified Model.

- The **EC-Earth Earth System Model** (EC-Earth ESM) has been developed by the EC-Earth consortium, gathering a number of national weather services and universities currently from 11 countries in Europe. EC-Earth component models are IFS for the atmosphere, NEMO for the ocean, and LIM for the sea-ice, and TM5 for atmospheric chemistry and aerosols coupled through OASIS. More components are planned for incorporation. In this context, the members of the Climate Prediction Group of the BSC-ES have been leading the implementation of the dynamical EC-Earth climate model as a forecast system. Their main target consists in developing initialization strategies for the forecast system to be a competitive tool for research and operations in sub-seasonal to seasonal global climate prediction. The group is for instance assessing the prediction of extremes in the European region at seasonal time scales (Doblas-Reyes *et al*., 2013a) and demonstrating the role of initializing new components such as the land surface or the sea ice to obtain more skillfull and reliable forecasts. The group is also a leader in decadal prediction, which stands as a newly emerged research field (Doblas-Reyes *et al*., 2011). Only recently, the fifth Coupled Model Intercomparison Project (CMIP5) included a retrospective decadal prediction exercise for the first time. In collaboration with the EC-Earth partners, the group developed a near-real-time decadal prediction capability (Du *et al*., 2012*;* Smith *et al*., 2013), which has lead to a large number of international collaborations in decadal prediction (MPI, ECMWF, CERFACS, SMHI, KNMI, IRI, Univiversity of Buenos Aires). With this new capability, the group participated in the CMIP5 multi-model experiment, a primer in the Spanish climate community, producing a set of decadal re-forecasts with EC-Earth initialized every year. This is an achievement reached by only eight institutions around the world, among which only the Met Office and the Climate Prediction Group together with SMHI completed a full set with full and anomaly initialization. The assessment of precipitation and surface temperature skill over the recent observational period (Corti *et al*., 2012; Doblas-Reyes *et al*., 2013b; Volpi *et al*., 2013) was a fundamental resource for the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Dr Pérez García-Pando in collaboration with the Climate Prediction Group will use and develop the EC-Earth ESM to investigate and eventually produce long-range dust predictions.

## Strategic Goals, Focus Areas and Approach of the AXA Chair

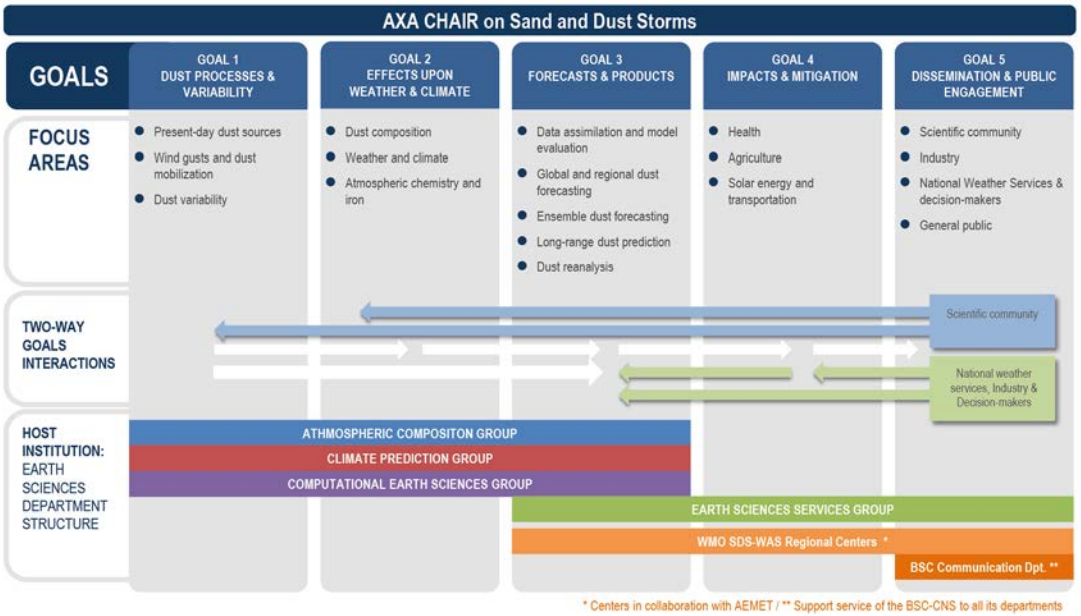


**Figure 2**: Strategic goals, focus areas, and their interactions along with the role of the BSC-ES research groups within the AXA Chair program. The program will improve SDS models by expanding our understanding of dust emission, transport and variability at multiple times scales (Strategic Goal 1). This will allow quantifying dust effects upon weather, climate, atmospheric chemistry and ocean biogeochemistry (Strategic Goal 2), and developing skillful short- and medium-range SDS forecasts and long-range dust predictions and projections (Strategic Goal 3). The Chair program will also focus on assessing SDS impacts upon key sectors of society and economy (health, agriculture, solar energy and transportation) (Strategic Goal 4), and promote SDS capacity building, technology transfer, dissemination and public engagement (Strategic Goal 5).

This section describes a unified and ambitious long-term research program to addresses the major challenges highlighted above, and provide cutting-edge technology, accurate forecasts and products, and capabilities to mitigate and assess SDS risks. We have identified **five strategic goals** supported by several **focus areas**. We describe below the specific challenges and general approaches that will be followed by Dr Pérez García-Pando, supported by the BSC-ES research groups and his international network of collaborators, to achieve the proposed goals (**Figure 2**).

## Strategic Goal 1: To expand our understanding of dust sources, emission, transport, and variability across multiple time scales

Dust emission depends upon both the strength of the surface wind and the condition of the land surface, which are controlled by processes that extend over multiple time scales. On the short-term, dust emission increases non-linearly like the third power of the friction velocity above a threshold, so that intense gusts make a disproportionately large contribution to the aerosol mass. Meteorological phenomena associated with dust mobilization include large-scale monsoon-type flows, synoptic-scale systems such as anticyclones, cyclones and their cold fronts, gust fronts generated by outflow from moist convective storms, and intense dry convection in the daytime planetary boundary layer (Knippertz and Todd, 2012). The so-called 'threshold friction speed' above which dust emission occurs, depends on soil texture, soil particle aggregation, soil humidity, and sheltering of the surface by non-erodible roughness elements such as vegetation, pebbles and rocks. Seasonal dust variations follow seasonal changes in the circulation and the vegetation. Interannual and decadal variations are controlled by changes in relevant climate parameters like the surface wind, the magnitude and distribution of precipitation, and modifications to vegetation cover resulting from both changes in climate and land use. Reducing current uncertainties in dust forecasts and projections requires an improved better understanding of these processes along with their proper representation in models. The plan is to focus on three areas of research.

**Focus Area 1.1. Present-day Dust Sources and Mobilization.** Current knowledge allows calculation of dust emission, provided that the required input parameters—surface, soil and meteorological features—are accurately determined. However, the success of emission schemes has been limited by parameter uncertainties, including those related to the representation of sub-grid-scale spatial and temporal heterogeneity, and inaccuracies of the driving meteorological fields. The identification of dust sources is one of the crucial aspects for representing dust mobilization in models. Traditionally, models used aridity as a criterion to identify potential dust sources (Tegen and Fung, 1994). Satellite retrievals subsequently showed that the most prolific sources occupy only a small fraction of arid regions (Prospero *et al*., 2002). These so-called 'preferential sources' are found within enclosed basins, where easily eroded soil particles have accumulated after fluvial erosion of the surrounding highlands. The implementation of preferential source functions based on topography (Ginoux *et al*., 2001), hydrology (Tegen *et al*. 2002; Zender *et al*. 2003), geomorphology, or satellite proxies, has significantly improved the skill of models by approximately locating large-scale natural sources. However, this approach is severely limited for representing small-scale dust sources and regions where the main sources are anthropogenic (cropland and pasture), which make a significant contribution to the dust load.

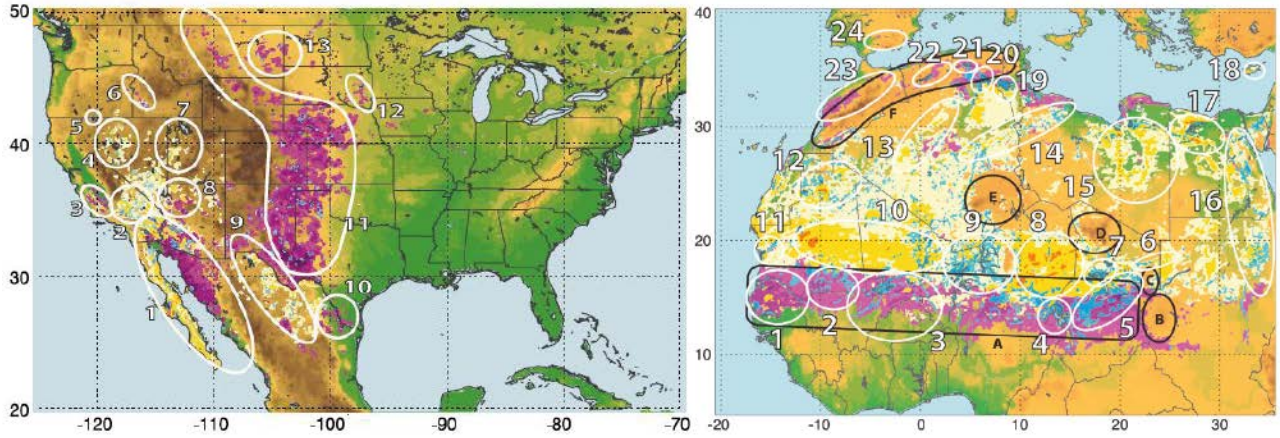


**Figure 3:** Distribution of the percentage number of days per season (March, April, and May) with MODIS Deep Blue-C5 for Dust Optical Depth > 0.2 over North America (left panel) and North Africa (right panel). The main sources are numbered and include among others the Sonoran Desert (1), the Mojave Desert (2) and the High Plains (11) in North America, and the Bodélé depression (7), Erg El Djouf (10) and the Lybian Desert (15) in North Africa. The frequencies associated with ephemeral water bodies, natural and anthropogenic land use are shaded in blue; yellow, red, and orange; and magenta, respectively. (Figure extracted from Ginoux et al., 2012)

Using the NMMB/BSC-CTM model, Dr Pérez García-Pando, and his colleagues Dr Paul Ginoux (NOAA GFDL), Dr Ron Miller (NASA GISS) and Dr Zavisa Janjic (NOAA NCEP) are currently evaluating and refining a new global-scale high-resolution mapping of dust sources and parameters for dust emission based on high-resolution satellite retrievals. The project entitled *"Implementation and testing of regional and global dust forecasting"* is being funded by NOAA's R2O Initiative for the Next Generation Global Prediction System (NGGPS), and mainly aims at developing NOAA NCEP dust prediction capabilities in North America. The group is developing a new high-resolution dust source inventory based on MODIS Collection 6 to provide a global distribution of present-day dust sources at an unprecedented resolution based on the frequency of days marked by high dust optical depth, where dust is attributed based upon the spectral dependence of the measured radiances. The new source map combines the MODIS data with land use databases to distinguish between natural and anthropogenic (primarily agricultural) dust sources including ephemeral water bodies. **Figure 3** shows the source maps for North America and North Africa using the previous (Collection 5) version of MODIS (Ginoux *et al*., 2012). Over most natural sources vegetation is sparse, the soil is dry, and the surface winds are strong, frequently exceeding the threshold velocity of wind erosion. However, this is not true in agricultural sources of dust, which are covered by crops (or litters after harvesting), and are located in moist areas or subject to irrigation. Dr Pérez García-Pando is working to constrain the threshold wind speed using the new dust source frequency map and available information on global soil and surface characteristics, including vegetation cover, soil texture, soil moisture and aeolian roughness length.

Within this focus area, Dr Pérez García-Pando supported by his team, including members of the Atmospheric Composition Group at the BSC-ES and his US collaborators will develop and use high-resolution dust source inventories derived from satellite retrievals combined with vegetation, land-use, soil and surface datasets, and other observations to accurately represent present-day dust sources in models at high resolution. In addition, they will evalute physically-based emission schemes that are sensitive to a changing climate (e.g., Kok *et al*., 2014), and quantify the relative contribution of natural and anthropogenic sources of dust. These novel approaches are expected to produce a major advance on the representation of present-day natural and anthropogenic dust sources and emission in the NMMB/BSC-CTM and other SDS models.

**Focus Area 1.2. Wind Gusts and Dust Mobilization**. Due to the non-linear relation between wind and dust mobilization, small errors on the surface wind speed in models lead to large errors in dust emission. Dust models show moderately good behavior when dust outbreaks are caused by synoptic-scale systems (e.g. Pérez *et al*. 2006b). However, the representation of haboobs—immense walls of blowing sand and dust produced by strong mesoscale downdrafts that regularly occur in arid and semi-arid regions (**Figure 1, bottom left**)—requires solving for the convection-scale circulation explicitly, which represents a formidable challenge. The simulation of wind gusts associated to topographic effects and dry convective eddies is also a challenge (Renno *et al*. 1998, Washington and Todd 2005), particularly for global models used to study the effect of dust upon climate, because of their coarse grid and long physics time step, which largely exceeds the typical time scale of intense gusts powered by eddy mixing (on the order of seconds to a few minutes). The plan is to work on two different but interrelated fronts within this focus area.

**For dust prediction on weather time scales**, the long-term goal is to represent haboobs in models explicitly, at first in regional models for short-range dust-weather forecasting, and in the longer term, in global models for medium-range dust-weather forecasts. At present, operational regional weather models are starting to represent large convective storms explicitly, and with the emergence of the next generation exascale HPC systems over the next decade, global forecast models that currently run at 10-15 km resolution are expected to provide convection-allowing medium-range forecasts. The NMMB/BSC-CTM is a non-hydrostatic multi-scale dust-weather model that has a strong potential for advancing our understanding, and developing, testing and implementing convection-allowing dust forecasts. Recent studies with the NMMB and other models have shown the potential for reproducing haboobs explicitly (Heinold *et al*., 2013; Vukovic *et al*., 2014). Within the R2O Initiative funded by NOAA, Dr Pérez García-Pando and his collaborators are currently studying the feasibility of forecasting massive mesoscale dust storms in North America using the NMMB/BSC-CTM model and the new high-resolution dust source map. There is also an on-going PhD. thesis on the subject at the BSC-ES. Among the major challenges to successfully simulate haboobs are current computational limits, the unavailability of high-resolution information characterizing the initial state of the atmosphere, and the limitations in explicit moist physics to reproduce evaporatively driven downdrafts. Within this focus area Dr Pérez García-Pando and his team will address those challenges by 1) systematically investigating haboobs at groundbreaking resolutions (1km) in North America, North Africa and the Middle East over extended periods of time taking advantage of the unique high performance computing facilities of the BSC-CNS, 2) thoroughly testing the wide variety of state-of-the-art moist physical packages available within the NMMB-BSC-CTM and, 3) in the case of North America, using assimilated high-resolution atmospheric initial conditions in collaboration with NOAA NCEP.

A few global models have included parameterizations to represent sub-grid wind fluctuations, mainly based on wind probability density functions, whose shape is determined either by the grid-resolved surface wind speed (Grini and Zender, 2004), or more adequately, by information on boundary layer turbulence, along with the occurrence of dry convective thermals and parameterized deep convective downdrafts (Lunt and Valdes 2002; Cakmur *et al*. 2004) There have been only few attempts at providing parameterized haboob deflation models (Miller *et al*., 2008; Pantillon *et al*. 2015). These approaches could be in principle implemented in dust models to include dust contributions from haboobs, but they haven't been properly tested nor used in dust models, and this important area of interest has been in general poorly addressed. **For climate modeling applications**, the goal is to test, develop, implement and evaluate parameterizations that represent wind gusts associated to dry convective eddies and convective downdrafts in coarser grid models used to simulate climate. The use of the non-hydrostatic multi-scale NMMB/BSC-CTM model developed by D. Pérez García-Pando will be crucial as it provides a unified modeling framework to compare and constrain the parameterizations developed for global coarse grids with regional convection-allowing simulations.

**Focus Area 1.3. Seasonal, Interannual and Decadal Dust Variability.** While models have improved the representation of the present-day dust cycle and its seasonality, they are typically unable to reproduce observed interannual and decadal dust trends. Observations show a doubling of global dust deposition during the 20th century and its attribution to natural and anthropogenic contributions remains uncertain (Mahoward *et al*. 2010). The inferred variations in emission are larger than those resulting solely from variations in meteorology (e.g. Stier *et al*. 2006, Koch *et al*. 2011), which implies that long-term dust variations must also be associated with changes in vegetation cover and lake area in arid and semi-arid environments driven by both anthropogenic land-use change and climate change (rainy and drought periods). The attribution of anthropogenic dust sources in Focus Area 1.1 benefits from high resolution and consistency with satellite retrievals of dust optical thickness, making it a valuable tool for present-day modeling and forecasting. In this focus area, we will attempt to represent the dust cycle at times outside of the satellite era when dust sources cannot be identified empirically. Dr Pérez García-Pando currently participates in a NASA project entitled *"Contribution to Radiative Forcing and Climate By Anthropogenic Sources of Soil Dust Aerosol"* together with Ron Miller, Jan Perlwitz (NASA GISS) and Paul Ginoux (NOAA GFDL). One of the objectives is to search for a relation between present-day anthropogenic dust sources and climate variables like the Palmer Drought Severity Index (PDSI). In this way, anthropogenic sources in the past could be derived from reconstructions of the PDSI, and for future values of PDSI, model projections of this variable could be used. Combined with atlases of past and future projections of land cover, this method could identify locations marked by cultivation and grazing that are vulnerable to wind erosion and are likely anthropogenic sources of dust aerosols. Another approach would be to use climate models including a dust emission scheme coupled to a dynamic global vegetation model (DGVM). Recent experiments have shown for the first time that it is possible to represent past dust variations by taking into account land-use change within a climate model coupled to a DGVM (Ginoux *et al*. in prep).

Dr. Pérez García-Pando's long-term goal is to reproduce and understand past interannual and decadal dust variations by implementing, constraining and evaluating physically-based emission schemes that are sensitive to changing climate using the EC-Earth ESM coupled with the LPJ-GUESS DGVM (Lindeskog *et al.*, 2013). A crucial aspect of LPJ-GUESS is it that takes into account cropland and pasture and their management, along with natural vegetation recovery and succession following cropland abandonment. Understanding and quantifying the interannual and decadal changes in dust sources is not only important for better understanding of 20$^{th}$ century climate change, but also a requirement to eventually develop long-range dust prediction and dust projection capabilities, while improving climate projections (see Focus Area 3.3).

## Strategic Goal 2: To Better Understand and Quantify Dust Effects upon Weather, Climate, Atmospheric Chemistry and Ocean Biogeochemistry

Dust aerosols perturb the atmospheric radiative flux at both solar and thermal wavelengths and influence cloud formation, altering the energy and water cycles both at weather and climate time scales. During transport, dust alters the photolysis of ozone, influences chemical reactions of other trace gases, and becomes coated with sulfate, nitrate, chloride, and organics. Dust deposition affects biogeochemical cycling in ocean and terrestrial ecosystems by supplying limiting nutrients such as iron and phosphorus. One of the largest contributions to the uncertainty of dust radiative forcing and its biogeochemical effects originates with the uncertainties in the dust emission and distribution. Reducing this uncertainty is part of Strategic Goal 1. Another significant challenge is that all these processes depend fundamentally upon the physical and chemical properties of the dust particles. However, models have typically assumed that dust aerosols have globally uniform composition, despite known regional variations in the mineral composition of the parent soil. Our research program will focus on the following areas:

**Focus Area 2.1. Dust Composition.** Constraining the size-resolved composition of dust aerosols is complicated. The composition of the emitted dust resembles to some degree that of the parent soil (Claquin *et al*. 1999; Nickovic *et al*., 2012). Yet, soil mineral grains and aggregates fragment during emission through saltation and sandblasting on the soil bed (Marticorena and Bergmetti, 1995; Shao 2001; Kok, 2011), which generates differences in the size distribution and mineral fractions between the parent soil and the emitted dust aerosols (Perlwitz *et al.* 2015a). In addition, global atlases only provide coarse estimates of soil texture and mineral composition that are extrapolated from the analysis of a limited amount of soil samples after wet sieving, a technique that breaks the aggregates encountered in natural undisturbed soils. Only a few models have attempted to simulate the global dust composition distribution (e.g., Scanza *et al*., 2015, Perlwitz *et al*. 2015b). Dr Pérez García-Pando is the director of a collaborative project funded by the US Department of Energy (DoE) between Columbia University, NASA GISS and Cornell University (Cornell's PI is Natalie Mahowald) entitled *"Improving the representation of soluble iron in climate models"* that will end this year. Because the iron content in dust particles depends upon mineral types, Dr Pérez García-Pando and his team recently proposed novel approaches to represent the emission and global distribution of mineral aggregates, which were tested within the NASA GISS Earth System ModelE against a new global compilation of observations (Perlwitz *et al*., 2015a, 2015b; Pérez García-Pando *et al.*, a and b in prep). The new methods remedy some of the deficiencies of previous implementations in comparison to observations. However, substantial uncertainty remains in evaluating models and the soil databases due to the limited number of size-resolved measurements of mineral content that sparsely sample aerosols downwind of the major dust sources. Dr Pérez García-Pando is also part of a proposal in preparation named "EMIT" for the NASA Earth Venture Instrument-3 (EVI-3) program, whose team includes researchers from JPL, NASA GISS, NOAA GFDL and Cornell University. The project would directly measure the surface mineral composition at very high resolution (~100m) by using imaging spectroscopy from the International Space Station (ISS), whose orbit provides ideal coverage for the dust source regions of the Earth. If the proposal is successful, the data provided by the new instrument would provide a $>10^5$ improvement in resolution over the current mineral dust source composition estimates derived from global soil maps.

Within this focus area, Dr Pérez García-Pando will develop additional projects to constrain the size-resolved mineral and chemical composition of dust by extending the existing theoretical models, using up-to-date soil mineral databases (Journet *et al*., 2014; and potentially the unprecedented EMIT retrievals), and closely collaborating with other world-leading experimentalists and theoreticians on size-resolved dust composition of the soil and the atmosphere (Sergio Rodriguez from the CIAI-AEMET, Xavier Querol from IDAEA-CSIC, Joe Prospero from U. Miami, Konrad Kandler from TUD, Johann Engelbrecht from DRI, and Jasper Kok from UCLA).

The results of this research will greatly reduce uncertainties in dust radiative forcing and soluble iron deposition, while improving both dust and weather/climate forecasts and projections. In addition, models with improved representation of dust mineralogy and chemistry will allow unprecedented health assessments.

**Focus Area 2.2. Effects upon Weather and Climate.** SDS interrupt the daily cycle of solar heating by dimming the surface. Over land, the ground cools with the passage of the dust layer overhead **(Figure 4)**, reducing the upward transfer of heat by the longwave and sensible fluxes. On time scales longer than a few days, the atmospheric temperature also adjusts to the dust forcing at Top of Atmosphere (TOA), which is a particularly strong constraint upon temperature at the surface in regions of frequent vertical mixing. Dust alters precipitation by changing the regional distribution of diabatic heating along with surface evaporation that supplies moisture to the atmosphere (Miller *et al*., 2014a). By changing precipitation, dust radiative forcing alters the regional distribution of vegetation, feeding back upon the mobilization of dust. Dust can act as cloud condensation nuclei (CCN) and ice nuclei (IN) influencing cloud formation and the associated radiative forcing (e.g. DeMott *et al*. 2003). While many studies emphasize the effect of dust forcing upon climatological precipitation, there is also an interest regarding the effect of dust upon tropical cyclones within the Atlantic, where dusty summers are associated with a reduction in cyclone activity (Evan *et al*. 2006). Understanding the observed relation remains a challenging and important topic, given the destructive power of cyclones and their potential to amplify in the warming climate.

Dr Pérez García-Pando and his colleague Slobodan Nickovic demonstrated that the inclusion of dust as a radiatively active substance in numerical weather prediction models could significantly improve short-term weather forecasts over dust-affected areas (Pérez *et al*., 2006a; **Figure 4**). They also related the decrease in dust emission to a reduction of eddy mixing within the boundary layer. Negative dust radiative forcing at the surface reduces the flux of sensible heat from the ground that powers eddy mixing in the arid regions that are dust sources. Together with his NASA GISS colleagues, Dr Pérez García-Pando has contributed to further understanding of the mechanisms by which dust affects global and regional climate (Miller *et al*., 2014a). Through the NASA MAP project entitled *"Contribution to Radiative Forcing and Climate By Anthropogenic Sources of Soil Dust Aerosol",* Dr Pérez García-Pando and his colleagues are calculating rainfall responses to anthropogenic dust forcing for the present-day focusing in regions with extensive

anthropogenic sources (like the Asian monsoon region or Australia) or societally important regions like the Sahel (Miller *et al*., 2014b).

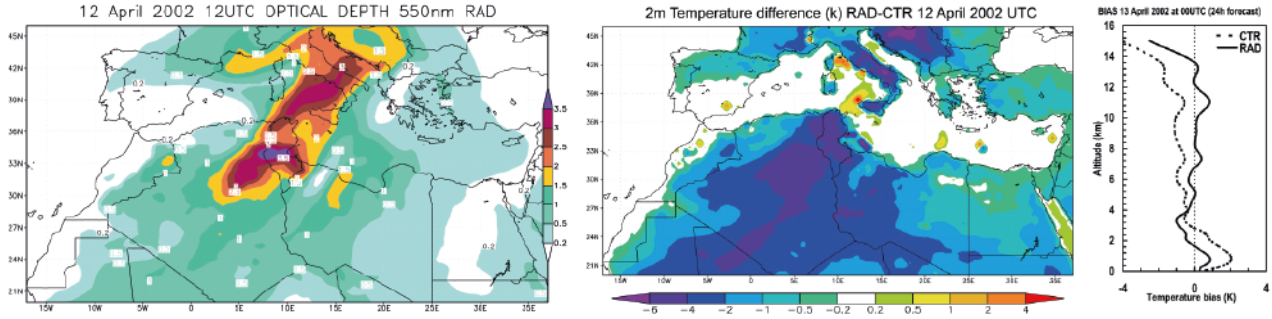


**Figure 4**. A dust storm on April 12, 2002 affecting the central Mediterranean as simulated by a model in terms of optcal depth at 550 nm (left). Contemporaneous change in surface air temperature attributed to dust by contrasting experiments with radiatively active dust and no dust (center). Bias reductions in temperature forecasts with the radiatively active experiment (RAD) compared to the control (CTR) (right) (Reproduced from Pérez et al. (2006).

This focus area will quantify the effect of anthropogenic and natural dust upon climate and the associated feedbacks, whose inclusion within models will improve short- and medium-range dust and weather forecasts. The plan is also to attempt to unravel the relationship between dust and tropical cyclone activity to improve forecasts and projections. In a first phase, we will use the NMMB/BSC-CTM model at synoptic time-scales to analyse the effects of absorption of solar radiation within the dust layer on tropical cyclone development. To this end, we will select appropriate cases that in the absence of dust would have led to hurricane development, and we will perform a sensitivity experiments by adding dust radiative forcing. This comparison will indicate whether dust heating can inhibit the formation of an individual hurricane, beyond the drying effect of the Saharan air within which it is embedded. In a second phase, the plan is to use the EC-Earth ESM to see how ocean temperature and hurricane activity respond to interannual variability of dust transport. This will reveal the influence of dust radiative forcing in tropical cyclone activity over the Atlantic on interannual and longer timescales. A key question is whether interannual variations in dust would be reflected in SST and hurricane activity or whether both quantities would respond instead to decadal variations in dust, whose forcing is smoothed out by the inertia of the ocean mixed layer. Alternatively, SST anomalies forced by dust might be so small that differences between the experiments are within the unforced variability of cyclone activity. In either case, the experiments would help to address the hypothesized role of SST in the empirical relation between dust and hurricanes that is often discussed in the current dust literature (e.g. Evan *et al*., 2009; Miller *et al*., 2012). Bringing his dust expertise, Dr. Pérez García-Pando will benefit in this task from the interaction with an expert on tropical cyclone predictability using the EC-Earth ESM at the Climate Prediction Group of the BSC-ES (Dr. Louis-Philipe Caron).

**Focus Area 2.3. Atmospheric Chemistry and the Iron Cycle.** Approximately one quarter of the carbon dioxide emitted since the industrial revolution has been taken up by the ocean (Ciais *et al*., 2013). In order to project future climate, it is crucial to understand how ocean uptake of carbon dioxide will be modified in this century. The supply of soluble iron to the oceans is fundamental to oceanic primary production and carbon dioxide uptake. Dust is estimated to contribute about 95% of the global atmospheric iron, while combustion sources (industry, biofuels and biomass burning) are responsible for the remaining 5% (Luo *et al*., 2008; Wang *et al*., 2015). Ocean productivity depends specifically upon the soluble or bioavailable fraction, which is poorly constrained by measurements. While iron solubility in soils is on average less than 0.1%, much higher solubility has been reported for atmospheric aerosols (e.g. Baker *et al*. 2006), which suggests that solubility increases during transport. Potential mechanisms include photo-reductive processes promoted by oxalate or other organic substances, in-cloud processing, and acidic attack by anthropogenic compounds (e.g. Pehkonen *et al*., 1993; Desboeufs *et al*., 2003). Anthropogenic effects upon the iron cycle are thought to be significant, with combustion sources contributing about 50% of the global soluble iron budget (Luo *et al*., 2008). Additionally, humans have drastically increased the acidity of the atmosphere in the last 100 years. Cultivated (anthropogenic) sources may be important as well since they are enriched in iron-bearing minerals including hematite and clays. Besides iron processing, the budget of atmospheric aerosols and gases and the associated effects upon radiation and clouds, are altered by the chemical reactions of dust with gases and other aerosol species.

In the context of the current NASA MAP and DoE projects mentioned above, Dr Pérez García-Pando and his colleagues are extending the NASA GISS ModelE and NCAR CESM models to calculate the global deposition of soluble iron and its uncertainty. In this focus area, Dr. Pérez García-Pando will aim to reproduce observed aerosol concentrations, precursor gases, and aerosol optical depths, which are modified

by chemical reactions involving dust. He will also constrain the deposition of soluble iron to ocean waters and its effect upon the carbon cycle in order to quantify the role of the natural versus anthropogenic sources of dust and iron (including combustion and cultivation). The plan is to design and implement iron processing mechanisms and dust heterogeneous reactions taking into account new experimental evidence and accounting explicitly for dust mineralogy developed in his previous work. Mechanisms with different levels of complexity for application in models have been proposed in the literature including processing by radiation, clouds, and heterogeneous reactions. Different processing hypotheses will be evaluated against available data and we will also introduce and test recent estimates of iron emission from combustion sources (Wang *et al*., 2015). One of the open questions is whether mechanistic complexity results in better agreement with the observations. This question is of interest to the broader modeling community who must choose the appropriate level of complexity in their own models. Alternatively, it may be found that more simple and empirical schemes perform as well and at a fraction of the computational cost.

## Strategic Goal 3: To Improve and Develop SDS forecasts, Predictions and Reanalysis Datasets

In the last years, the development of global and regional SDS forecasts has intensified because of their potential to mitigate impacts upon transportation, energy production, health and agriculture. In addition, operational weather services have started to recognize the importance of representing dust in models to reduce systematic temperature biases (Pérez *et al*., 2006a) and improve data assimilation in weather forecasting (Benedetti *et al*., 2014). Dust predictions and projections at longer time scales are important for climate prediction, and can be of interest for seasonal health early warning systems, and long-term risk assessments for agriculture and other sectors. Uncertainties in models and planned developments related to dust processes at multiple time scales are addressed within the previous strategic goals and focus areas. This Strategic Goal applies to remaining challenges specific to the development and improvement of short- and medium range forecasting and long-range prediction capabilities.

**Focus Area 3.1. Data Assimilation and Model Evaluation.** Besides the uncertainties in representing dust physical processes, there are enormous challenges in the availability and use of dust observations for data assimilation and evaluation in regional and global dust forecasts. While satellite dust products have helped identify major dust features, most retrievals only provide qualitative information, particularly over the bright desert regions that are dust sources, where the aerosol signal cannot be easily isolated from the surface reflectance. There are some quantitative products available over dark targets such as oceans, but these only weakly constrain aerosol loads upwind over the source region. Even with these and other limitations, dust forecasts including data assimilation have shown significant improvements compared to forecasts whose dust initial conditions only depend on model estimates. Another important limitation for the advancement of operational dust forecasts is the lack of standardized evaluation procedures, suitable observations and a poorly developed verification systems compared to numerical weather prediction (NWP). While NWP benefits from advanced near-real time observing systems and well-established protocols for the evaluation of forecast products, similar procedures for dust forecasting are only at their beginning. This focus area will be devoted to the improvement of dust and weather forecasts at both regional and global scales by further developing dust data assimilation methods combining new and forthcoming quantitative satellite products available in real-time, and developing procedures and protocols for the evaluation of forecast products.

The Aerosols, Clouds and Trace gases Research InfraStructure network (ACTRIS, http://www.actris.net), and ACTRIS-2 are European projects aimed at integrating ground-based stations equipped with advanced atmospheric probing instrumentation for aerosols, clouds, and short-lived gas species as EARLINET (European Aerosol Research Lidar NETwork; Pappalardo *et al*., 2014, http://aeronet.gsfc.nasa.gov) and AERONET. BSC-ES is currently contributing to ACTRIS2 by establishing a routine verification stream of selected ACTRIS2 variables with daily updates. In addition, BSC-ES is exploring the potential of ACTRIS2 data for assimilation and satellite bias correction by setting up pilot studies.

For data assimilation, the BSC-ES has recently enhanced the NMMB/BSC-CTM with dust data assimilation capability, implementing an ensemble-based scheme that evolves during forecast. The assimilation of quantitative column-integrated dust aerosol products has improved the characterization of the aerosol load (Di Tomaso *et al.,* 2014). This has required the usage of ancillary satellite-retrieved information on aerosol optical properties, load, size and absorption efficiency. The recent development of algorithms retrieving dust properties from satellite reflectances in the blue range of the visible spectrum has led to the extension of quantitative dust information to the source regions that are often characterized by bright surfaces (MODIS Deep Blue Collection 6) (Di Tomaso *et al*., 2015). The future enhancement of global observing systems for aerosols shows further exciting perspectives: the future European Space agency (ESA) Sentinel missions, Sentinel-4 and Sentinel-5, are planned to be launched respectively in 2017-19 and 2020 specifically for the operational needs of the Copernicus programme. Sentinel-4 in particular will improve diurnal sampling of radiances that constrain tropospheric aerosol concentrations. With the AXA Chair support we will be able to

complement the assimilation of observations from polar-orbiting satellites (with high spatial resolution but few daily measurements) with the assimilation of observations from geostationary satellites (whose limited spatial resolution is offset by nearly continuous temporal coverage). Furthermore, the EarthCare mission developed as a joint venture between ESA and the Japan Aerospace Exploration Agency (JAXA), will bring in the near future an additional active instrument that will provide in near-real-time information on aerosol speciation and vertical distribution. Thanks to recent optimization of instruments and data processing schemes, EARLINET plans to make available in near-real-time backscatter vertical profiles, which will be an important step for lidar data assimilation in models. Beside its operational production of aerosol analyses, data assimilation has shown to be a powerful tool for parameter estimation. Given that emissions and meteorology are the main drivers for dust forecasts, a combined estimation of dust state variables and parameters through data assimilation would be of great advantage as it can actively correct emission estimates that lead to forecast errors.

**Focus Area 3.2. Global and Regional Dust Forecasting with Embedded Nests.** The NMMB is a non-hydrostatic atmospheric model that can be run either globally or regionally with embedded 1-way or 2-way static or moving nests to create local regions of high resolution, which represents a unique capability. The first implementation of NMMB at NCEP was in the North American (NAM) modeling suite. In the NAM, the NMMB runs over the existing North American domain to 84-h, within which are four static 1-way nests which run to 60-h: 4 km Contiguous United States (CONUS), 6 km Alaska, 3 km Hawaii, and 3 km Puerto Rico. Within either the CONUS or Alaska nest a placeable on-call nest at 1.333 km (CONUS) or 1.5 km (Alaska) is run to 36-h to provide support for fire weather and other hazardous situations **(Figure 5)**. Currently, Dr Pérez García-Pando is part of the research team funded by NOAA's R2O Initiative to test the feasibility of dust forecasts at CONUS with the NMMB/BSC-CTM. On the other side, currently the BSC-CNS provides separate global and regional dust forecasts for Northern Africa, Middle East and Europe at 1.4 x 1 degree and 0.1 x 0.1 degree resolution respectively **(Figure 5)**.

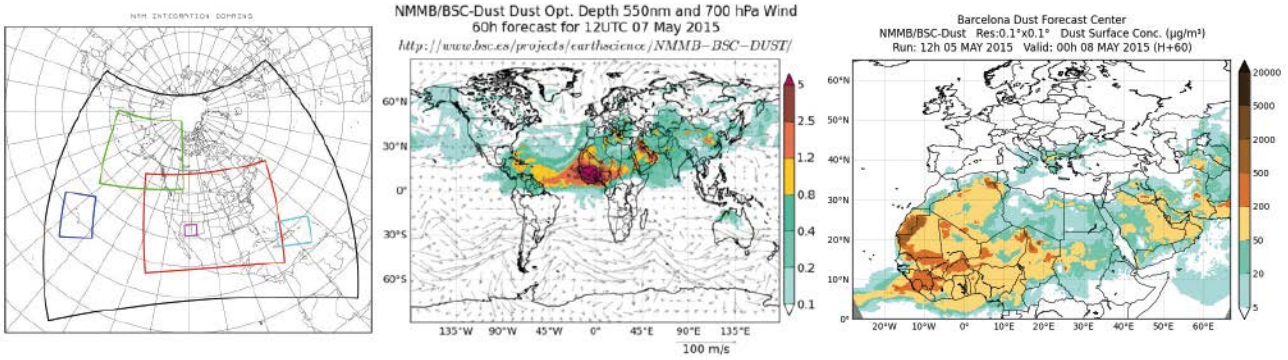


**Figure 5.** NMMB weather forecast nested domains for CONUS at NCEP (left). Global dust forecast with the NMMB/BSC-CTM at the BSC-CNS (center). Regional dust forecast with the NMMB/BSC-CTM at the BDFC (right).

The goal of this focus area will be to use all the scientific advances on dust cycle modeling by the team and other collaborators to provide the most up-to-date dust forecast products. Taking advantage of the unique capabilities of the NMMB we aim at providing 10-20 km global dust forecasts with embedded high resolution nests (3-4 km) over the major source regions (Northern Africa, Middle East, West and East Asia, North America, South America and Australia) over the next decade within a single execution of the model. Dr. Pérez García-Pando and his team will analyze whether the 2-way capability of the model (allowing the small-scale dust emission processes at source regions within the high-resolution regional nests to impact the intercontinental dust transport in the outermost global domain) improves global dust forecasts. This goal involves several challenges that will be addressed in close collaboration with NOAA NCEP. The forecast system will benefit from the introduction state-of-the-art atmospheric and dust data assimilation along with scale-aware physical parameterizations. The support of the Computational Earth Sciences Group at BSC-ES will be crucial to prepare faster parallelized pre- and post-processing packages, migrate the system over time into new exascale computing paradigms at BSC-CNS, and provide new tools to quickly access and visualize massive amounts of gridded data.

**Focus Area 3.3. Probabilistic Forecasting and Multi-model Ensembles.** The improvement of models will permit a better characterization of the dust cycle and, consequently, more precise forecasts. However, the models will always have some limitations related to the mathematical representation of the simulated processes, the lack of suitable observational data and the imperfect representation of the soil characteristics and state. Ensemble prediction aims to overcome these limitations through the description of the future state from a probabilistic point of view. Multiple simulations are run to account for the uncertainty of the initial state along with any inaccuracy of the model. Multi-model forecasting intends to alleviate the shortcomings of individual models while offering an insight on the uncertainties associated with a single-model forecast. The

WMO Regional Center at the BSC-CNS daily computes multi-model products from the following set of models: BSC-DREAM8b, MACC, DREAM8-NMME-MACC, NMMB/BSC-CTM, MetUM, NASA GEOS-5, NCEP NGAC, EMA RegCM4 and DREAMABOL. Two products describing centrality (median and mean) and two products describing the spread (standard deviation and range of variation) are daily computed and posted on the web portal. The fact that multi-model median proved to achieve better evaluation scores than any individual model, encourages further research in this field.

Through this focus area the team will contribute and coordinate ongoing collective efforts with collaborating institutions to provide multi-model probabilistic dust forecasts. At the same time, the process can strongly contribute to the improvement of individual models by exhaustive multi-model comparison against observations. Future work will be done with a single model run with different parameterizations and with the introduction of stochastic perturbations to a reference run. When the assimilation techniques for atmospheric aerosol are more developed, the generation of equally probable forecasts starting from multiple realistic initial conditions, similarly as what is currently done in numerical weather forecasting, is expected to significantly contribute to the improvement of dust forecasts.

**Focus area 3.4. Long-range Dust Predictions.** The ability to forecast dust at long lead times would enable better preparation for the risks presented by SDS. Several agencies produce long-range forecasts for temperature, precipitation and other climate variables for various regions with lead times of several weeks to several seasons. However, none of these agencies produces long-range dust storm predictions. However, this area of opportunity contains major challenges. Given the complicated dependence of dust generation upon slowly-evolving surface conditions (such as vegetation and land use) as discussed in Focus Area 1.3, it remains an open question whether long-range predictions of soil moisture, wind and gustiness over dust source regions can be good enough to produce skillful predictions of dust storm frequency. At present, a potential candidate is the seasonal time scale. Forecasting climate at the seasonal range depends on slowly evolving components such as the sea surface temperature (SST). When considering El Niño, a quasi-oscillatory phenomenon that evolves more slowly than synoptic weather systems, skillful climate forecasts of monthly mean or seasonal mean conditions can be made for certain regions with lead times of 6 to 12 months. Particularly challenging (and only recently gaining attention within the scientific community) are sub-seasonal forecasts (between 2 weeks and 2 months) since at these lead times the memory of the atmospheric initial state is diminished any predictable evolution of the ocean state has not yet occurred. Decadal decadal predictions, which lie in a zone between seasonal/interannual forecasting and longer-term climate change projections, also exhibit a low signal-to-noise ratio. The long-term objective of this challenging focus area is to test the feasibility and eventually deliver skillful long-range predictions of dust storm characteristics. This will involve understanding the relationship between climate variations, e.g., El Niño/La Niña, the Madden-Julian Oscillation (MJO) and the North Atlantic Oscillation (NAO), and dust variability using atmospheric reanalysis and dust observations to analyse the sources of predictability. This focus area will also test hindcasting of observed dust variations using the EC-Earth ESM, which will include a physically-based dust emission scheme connected to a dynamic vegetation model. Given the potential link between hurricanes and dust, skilful seasonal forecasts of dust have to potential to improve hurricane seasonal forecasts.

The Climate Prediction Group at the BSC-ES represents one of the best places in the world to undertake this task because of its unique infrastructure to produce climate predictions and the recently started interaction with the Atmospheric Composition Group. The combination of both groups, along with the experience in the development of EC-Earth and in its use as a climate forecasting system, offers the ideal environment for Dr Pérez García-Pando to bring together his SDS knowledge and address a problem that no other institution has been able to do yet.

**Focus area 3.5. Dust Reanalysis**. One of the challenges in studying dust aerosols and their impact is the paucity of direct in-situ measurements in the areas most affected by SDS. For example, coverage of weather-observing sites in Africa is sub-optimal with only 1/8th of what is considered as minimum coverage, and many historical climatic datasets are still on perishable media. There are some operational visibility observations providing qualitative estimates of dust, but there are no routine surface concentration measurements. In general, we lack high-resolution observations and we have limited information on aerosol speciation, which is essential to distinguish dust from other aerosol types. Satellites provide column-integrated aerosol measurements, but estimates of surface dust concentration and deposition along with their chemical and mineralogical composition are needed to establish detailed assessments for sectors such as health and agriculture. In this respect, model simulations can complement remote sensing and in-situ observations and help address deficiencies in the observing system. The goal of this focus area is to produce accurate high-resolution dust reanalysis datasets using models, along with satellite and ground-based observations, which can contribute to the formulation of mitigation plans related to health, the ecosystem and the energy sector at regional and local levels. Thanks to increasingly available computational resources, the high-resolution simulations of the NMMB/BSC-CTM can better represent mesoscale features

and allow for a dust reanalysis product at unprecedentedly fine spatial scales. The ensemble-based data assimilation scheme coupled to the NMMB/BSC-CTM model has the ability to calculate uncertainty of the analysis product that is important for characterizing the accuracy of climate monitoring as well as the quality of forecast verification. Analysis uncertainty also guides the design of the global observing system network in terms of coverage or type of instruments and variables most needed to reduce such uncertainty.

There are a few key points on which further development of dust analyses should be focused: the assimilation of aerosol particle size and absorption products, in order to distinguish the contribution of the dust component; an accurate characterization of the representation error of sparse observations to improve their assimilation; the exploitation of high-quality in-situ observations, when available, as these have the potential to disproportionately reduce the analysis uncertainty; the improved representation of vertical aerosol structure with the assimilation of ground-based and space-borne backscatter profiles. The latter measurements have the potential to greatly improve the three-dimensional description of dust outflows from their source. In this field, the Chair will benefit from the collaborative network of ACTRIS-2, a EU H2020 research infrastructure project in which the department is involved, to assess the benefit of assimilating ground-based lidar measurements from EARLINET.

## Strategic Goal 4: To assess and mitigate dust impacts on key sectors of society and economy

SDS can severely disrupt communications, as well as ground and air transportation. Even moderate dust concentrations affect solar radiation production systems, damage croplands, and compromise air quality and human health. There are many potential applications for SDS early warnings and products, which can be grouped into tactical, strategic, and research applications. The tactical applications focus on actions that can be taken in the short term, whenever forecasts predict SDS at a certain location and time. Strategic applications are those related to long-term planning and investments. Another potential application is to assist with post-dust storm assessments. National governments and international institutions need to know the precise causes for air quality degradation, epidemic outbreaks or crop damages. Finally, other scientific communities, such as the public health community, need spatially and temporally resolved dust data to attribute the effects of dust particles upon a range of ailments. The delivery of accurate information on past trends, current analysis and forecasts is a prerequisite for decision making at multiple time scales. However, this is not the only challenge. Other key impediments include a lack of understanding of the precise role of SDS upon certain sectors; the lack of products tailored to specific applications; the lack of awareness, understanding, capacity or structures in place to use the information, and the challenge of or reluctance to incorporating uncertain information or forecasts into management practices. Our activities will focus on the following areas:

**Focus Area 4.1 Health.** SDS cause unhealthful levels of dust particles not only in arid and semi-arid environments but also in distant areas due to long-range transport. Health studies have generally focused on urban areas and only a few have quantified the effects of differentiated mineral dust upon human health. At present, there is little understanding on the factors (e.g. composition, particle size), exposure levels and biological mechanisms responsible for the observed health effects of dust, and there is a lack of studies in many areas where dust exposure is consistently high such as sub-Saharan Africa. The development of dust concentration and composition historical datasets (Focus Area 3.5) will contribute to new health assessments. We plan to use dust products in collaboration with the health research community to assess potential impacts of dust upon human health. In Southern Europe (and other regions), dust forecasts may help hospitals anticipate peaks in respiratory-related emergency room visits. By analyzing the number of such visits and their relationship with dust (mixed with other anthropogenic pollutants) an algorithm could be developed that would predict a low, medium or high number of respiratory-related visits on a given day, allowing the hospital to be better prepared, and ensuring that enough qualified staff and proper equipment are available on the peak days. The BSC-ES has ongoing collaborations with the Institute of Environmental Assessment and Water Research (IDAEA-CSIC) and the Center for Research in Environmental Epidemiology (CREAL) in Barcelona. Both are leaders in the assessment of aerosol impacts upon human health. We will provide the modeling and forecasting component to assess, predict and mitigate aerosol effects upon human health.

Another major theme in this focus area is meningococcal meningitis in sub-Saharan Africa, which is one of the most feared dry-season infectious diseases because of its rapid onset, high fatality rates and induced long-term disabilities. Vaccines for many strains of meningitis typically provide immunity for only two to three years. For this reason, the strategy has been reactive vaccination only in anticipation of a specific outbreak. When the number of cases in a certain district reaches a threshold, vaccinations are ordered **(Figure 6)**. Very often the response comes too late and therefore the strategy can benefit from forecasting tools. The intensity and dynamics of meningitis serogroup A epidemics led to the development of a conjugate vaccine introduced in 2010 that provides long-term immunity. This is reducing the threat of epidemics but other

serogroups continue to be a problem. For example, during this past dry season, a meningitis epidemic of serogroup C in Niger infected well over five thousand people and killed more than 350.

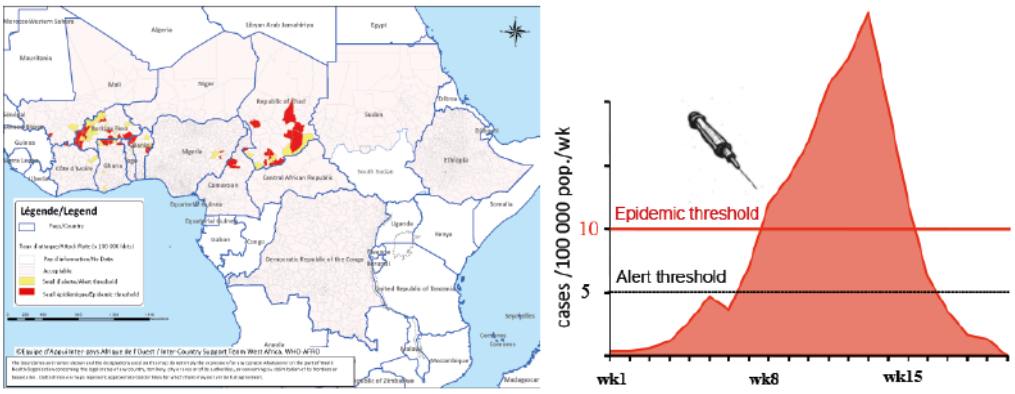


**Figure 6.** (Left) Districts' alert and epidemic status in the meningitis belt based on weekly highest attack rate, from week 1 to 43, 2012. Two years after the introduction of the meningitis A conjugate vaccine, meningitis serogroup W135 (Nm W135) was predominant and responsible for outbreaks in Côte d'Ivoire, Ghana, Benin, Burkina Faso - the country most severely hit by meningitis in 2012 - and increased incidences in Mali, the Gambia and Senegal. Chad was the only country affected by meningitis A epidemics, in areas not yet covered by the conjugate vaccine. (Source: Meningitis weekly bulletin, WHO IST-West); (Right) The figure shows a typical seasonal cycle of meningococcal meningitis. A vaccination campaign begins when the number of cases in a region reaches the epidemic threshold, defined here as 10 cases per week per 100,000 inhabitants.

The heterogeneous spatial and temporal distribution of epidemics and the seasonality of the disease indicate that complex interactions involving host, organism and environment are necessary for an epidemic to occur (Greenwood *et al*., 1987; Moore *et al*., 1992). The most likely hypothesis concerning the role of the environments is that dry and dusty conditions damage the pharyngeal mucosa, which facilitates bacterial invasion (Pérez García-Pando *et al*., 2014b). The prediction of epidemics is challenged by the lack of spatially and temporally resolved near-real time information on the levels of carriage of the bacteria, population immunity and serogroup type and virulence. Although weather/climate and other environmental data contain uncertainties, they have shown the potential to improve meningitis forecasting. Prior work by Dr Pérez García-Pando and his collaborators, including Madeleine Thomson (IRI), Ron Miller (NASA GISS), Thomas Hopson (UCAR), Peter Diggle (U. Lancaster) and Stephane Hugonnets (WHO) has established that statistical models including weather and dust aerosol data as inputs, could potentially forecast the risk of epidemics, saving lives and effectively allocating scarce vaccine resources **(Figure 7)** (Pérez García-Pando et *al.*, 2014a; Pandya *et al*. 2014). Dr Pérez García-Pando aims at improving and transitioning these models to improve the current operating and decision procedures for meningitis control by the World Health Organization (WHO), the Ministries of Health of the affected countries and their development partners. A key end-user of this focus area is the World Health Organization (WHO), who provides technical assistance and support to Ministries of Health to improve the prevention and control of meningitis epidemics in the region. In its role as Secretariat of the International Coordinating Group (ICG) for Meningitis Vaccine Provision, WHO is responsible for the management of the global emergency vaccine stockpile and works closely with other ICG partners (UNICEF, Médecins Sans Frontières and the International Federation of the Red Cross), vaccine manufacturers and Member States to ensure a rapid response to meningitis outbreaks. Ultimately, WHO would like to synthesize research outcomes in such a way as to support its activities in the field and strengthen the decision algorithm that determines the timing and distribution of vaccines to countries during an epidemic season.

Besides meningococcal meningitis, the dry season's climate and disproportionate concentration of dust aerosols promote other infectious respiratory diseases caused by viruses, bacteria or other pathogenic microbes, causing pneumonia, bronchitis, and other ailments. In this sense, the plan will be to enhance the access of the African Center for Meteorological Applications for Development (ACMAD), the weather and climate organization with African continental authority, to policy-relevant climate and environmental information including dust, tailored to the dry season and its related health vulnerabilities. This area of cross-disciplinary research will leverage technologies developed through two previously funded awards (NASA and Google), and would provide the opportunity to transition and integrate the developed technologies into two partner end-user operations (WHO and ACMAD). To our knowledge, this would be the first occurrence of actively collected environmental data impacting African disease mitigation protocols, potentially leading the

way for benefits to other continental disease mitigation strategies as climate change continues to modify background incidence rates and geographical extent.

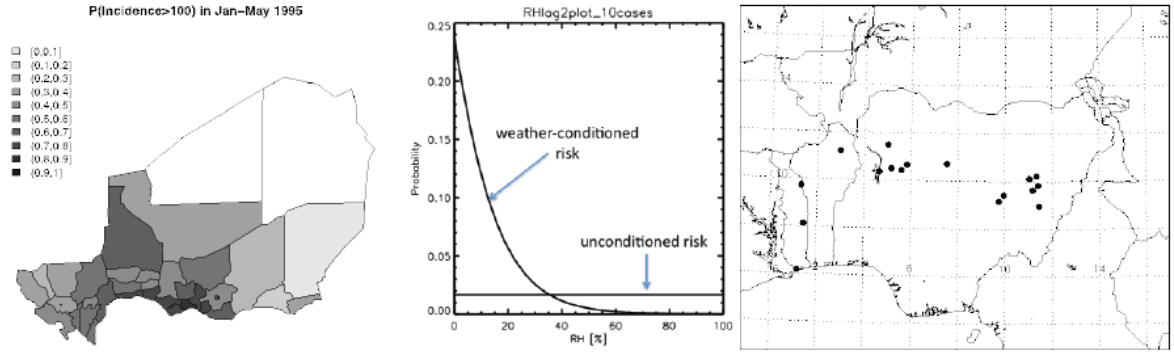


**Figure 7.** (Left) Predicted probabilities of exceeding the seasonal epidemic threshold from a model including December incidence (national, district-level, and average of neighbors) and climate (zonal wind and dust concentration) and population density (Pérez García-Pando *et al*., 2014a, 2014b); (Center) A log-plot of the probability of a district crossing epidemic threshold generated by a differential equation-based model of disease propagation whose coefficients depended on relative humidity and other weather variables (weather-conditioned risk) and ignored all weather variables (unconditioned risk). The line for weather-conditioned risk shows an inflection point at about 40% relative humidity, with the probability of epidemic increasing significantly in districts when the relative humidity is less than 40%. For comparison, the unconditioned risk is about 0.018, which can be understood as the probability of epidemic predicted without knowing the relative humidity. Extracted from Pandya *et al*. (2014); (Right) Districts with at least one avoidable vaccination campaign between 2006 and 2011. In each of these districts, a vaccination campaign was launched less than six weeks before the onset of high-relative humidity would have ended the epidemic naturally. Given the population of these districts, this accounts for about 2.6M vaccines, which used elsewhere more effectively could have prevented as many as 24,000 cases of meningitis and 2400 fatalities.

**Focus Area 4.2. Agriculture.** The most direct impact of SDS upon agriculture is the loss of crop and livestock. Sandblasting results in direct loss of plant tissue, which reduces photosynthetic activity, and therefore the growth, reproduction, and development of grain, fibre, or fruit (Stefanski and Sivakumar, 2009). With appropriate user consultation, SDS warning advisories, assessments and tools could help mitigation and adaptation actions to be taken in advance, including harvesting of maturing crops and sheltering livestock, changing the time of planting, strengthening infrastructure, and constructing windbreaks and shelterbelts (Stefanski and Sivakumar, 2009).

Another application is the use of accurate dust products to inform index insurance initiatives for farmers in North Africa. Weather-based index insurance is a promising tool for development, climate risk management and adaptation. However, poor data and uncertainties in climate information combined with inconsistent implementation practices threaten the viability of insurance as a larger scale adaptation instrument in developing countries. Our partner, the IRI, has already helped identify and address many of the key obstacles to using index insurance to meaningfully address poverty at large scales and over the next years plans to move index insurance beyond the pilot phase, and support interventions at larger scales (http://iri.columbia.edu/news/an-index-insurance-primer-2/). We plan to support and engage with the IRI on this task by providing up-to-date dust products and receiving feedback on the current and future needs. The Chair program will also engage with AXA insurance experts to explore and develop the potential for SDS products and assessments in this field.

**Focus area 4.3. Solar Energy Production and Transportation.** Dust can severely affect solar energy production (Schroedter-Homscheidt *et al*. 2013) and the transport sector (Shirkhani-Ardehjani, 2012). Solar power forecasting prevents energy loss and improves the management of solar plants. Recent studies have shown that the accuracy of existing weather models to predict solar irradiance is not always satisfactory and that a large proportion of the uncertainty can be attributed to the lack of accurate aerosol data (e.g. Ruiz-Arias *et al.*, 2011; Gueymard, 2012). By coordinating and guiding impact modellers and in-house software developers, Dr Pérez García-Pando will help solar energy managers to obtain skillful DNI forecasts for the coming days and long-term assessments for site planning. The Earth Sciences Services Group has large experience in the field of renewable energies. Currently the group works in partnership with climate scientists and energy stakeholders, to disseminate state-of-the-art, seasonal-to-decadal climate information from research to the downstream, actionable decisions at local, national and global scales (Doblas-Reyes *et al*., 2013a). Partnerships have been initiated with several key energy stakeholders from the private, public and research areas via the EU projects CLIM-RUN, and more recently EUPORIAS and SPECS (coordinated by Dr Doblas-Reyes). Within CLIM-RUN, probabilistic forecasts for wind and solar energy were produced and disseminated to a number of stakeholders. This innovative effort led the members of the group to start the

Advancing Renewable Energy with Climate Services (ARECS) initiative to create a research, networking and communication platform for climate services. This platform will help the AXA Chair SDS program to engage with interested stakeholders. We also plan to engage with the on-going DNICast project (http://www.dnicast-project.net), which aims at bringing a series of innovative components to advance current state-of-the-art in terms of methodological progress, geographical extension and a participatory approach through the involvement of stakeholders and potential end-users in the field of solar radiation management. According to consultations by DNICast, there are different applications of forecasts, which are priorities for the plant operators, including the daily market (forecasts of the DNI 24 hours ahead with hourly frequency), the intraday market (forecasts every 4 hours with hourly predictions) to manage the power generation schedules, and operations specific to each power plant.

With respect to the transport sector, SDS can have a substantial impact on air and road traffic through visibility reduction. Poor visibility conditions are a danger to aircraft landing and taking off, as well as to airport ground operations. Therefore, aerodromes operating in such conditions are required to set low visibility procedures (LVP) in force. This implies a reduced movement rate and, therefore, increased likelihood of delayed departures, diverted flights and airport operational problems. A precise prediction can minimize the time when LVP are in place and reduce their negative effects.

Surface extinction, a parameter computed by SDS models, can be used to predict visibility reduction by dust using approximations such as the classic Koschmieder formula (Koschmieder, 1925). The accuracy of such visibility forecasts needs to be thoroughly assessed through the routine evaluation of SDS models with observations performed in airfields and meteorological synoptic stations. Once the feasibility to release precise forecasts had been demonstrated, consultations with various stakeholders will be opened to define the most appropriate formats and distribution channels. Key potential stakeholders could be the International Civil Aviation Organization (ICAO), National Metorological Services and other providers of meteorological services for aviation.

**Strategic Goal 5: To promote SDS capacity building, technology transfer, dissemination and public engagement**

The reader is referred to Section 5 of this application (Partnership Implementation) for the description of this important Strategic Goal.

## Global Positioning of the AXA Chair on Sand and Dust Storms

The international and collaborative nature of the WMO SDS-WAS is an attempt at putting together traditionally disconnected communities of practice towards addressing the complexity of SDS and their effects: on the one side, the scientific community working on SDS observations, forecasts and analyses, and on other side operational centers such as meteorological services—typically lacking SDS capacities, particularly in less developed and severely affected countries—, and potential users of the information in the fields of health, agriculture, transport, energy production and others.

WMO took a lead with international partners to establish the SDS-WAS to develop, refine and provide a basis for distributing to the global community products that are useful in reducing the adverse impacts of SDS and to assess impacts of the SDS process on society and nature. The SDS-WAS is structured around two regional nodes, coordinated by two respective Regional Centers, which were designated as such for their excellence in this research field.

The Regional Center for Northern Africa, Middle East and Europe is jointly managed by AEMET and the BSC-CNS. It collects and distributes in-situ and remote-sensing dust-relevant observations, daily experimental dust forecasts from several organizations, information and training material from several past workshops, and news for the SDS-WAS community. Detailed description on all these issues can be found in its 2010-2012 Activity Report (Terradellas *et al*., 2014). In May 2013, WMO designated the consortium formed by AEMET and the BSC-CNS to create the first Regional Specialized Meteorological Center with activity specialization on Atmospheric Sand and Dust Forecast. The Center, which started operations in March 2014 under the name of Barcelona Dust Forecast Center (BDFC), generates and distributes operational forecasts.

The Regional Center for Asia, created in Beijing, China, is managed by the China Meteorological Administration (CMA). CMA has also been coordinating research on airborne dust conducted in China, Japan, Korea, Mongolia and Kazakhstan, and is now laying the groundwork for the development of operational services. Thus, the BSC-CNS is uniquely positioned in the field, as it has managed to coordinate the efforts of multiple partners, allowing implementation of the only operational forecasting services for airborne dust fully recognized by WMO. The main European and international institutions involved in the

observation and prediction of dust are among the partners of the Regional Center. Examples include EUMETSAT, ECMWF, NASA, NCEP and many National Meteorological Services.

By creating an AXA Chair on SDS at the BSC-CNS, the AXA Research Fund would not only support the mission and ensure the existence and long-term strategy of the two WMO SDS Regional Centers based at the BSC-CNS, but, as reflected by the comprehensive research program presented above, also would largely expand their current scope and relevance.

## Partnerships

Both Dr Pérez García-Pando and the BSC-ES have a long list of active collaborators, partners and end-users, which are displayed in **Figure 8**. Some of these collaborations have been briefly described within the program description section above. Both the AXA Chair and our collaborators will benefit of such a program. In its role as WMO Regional Center, the BSC-CNS is particularly well positioned to utilize SDS advances not only developed in-house but also at other collaborating research centers and laboratories worldwide for the benefit of society. Dr Pérez García-Pando will additionally serve as a bridge between the US and European research efforts on SDS and their alignment towards impacting the way SDS are managed in the future.

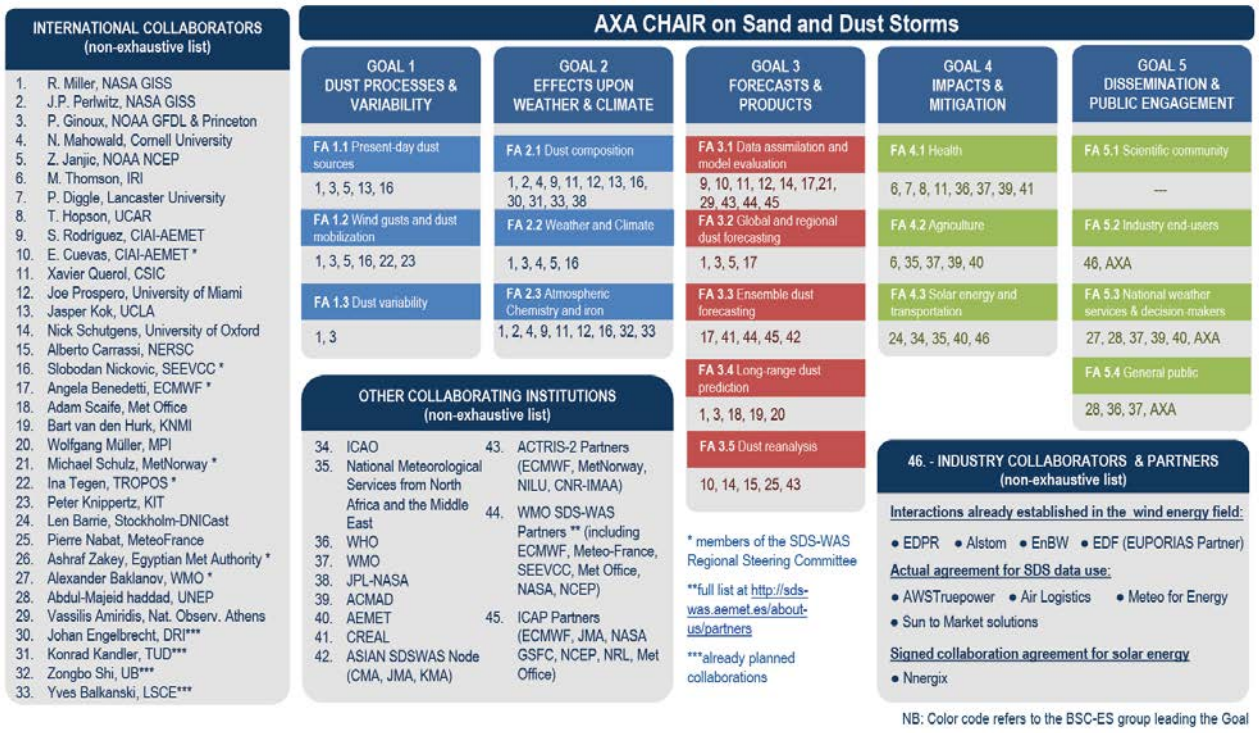


**Figure 8.** International collaborations (active or already planned), partnerships and end-users within within each focus area. Some of the collaborators are members of the WMO SDSWAS Steering Committee.

## AXA Co-Funding

Recruiting Dr Perez García-Pando from NASA and developing such an ambitious program would only be possible with AXA's long-term support. The contribution of AXA to the Chair compared to other funding sources is detailed in Section 4 (**AXA Chair's budget)** of this application**.**

# 2. Major qualifications of the candidate for the AXA Chair and other contributors if any

**CHAIR HOLDER CANDIDATE**

**Dr Pérez García-Pando** was born in Barcelona, Spain, in 1977. He is both an Industrial Engineer from the Universitat Politècnica de Catalunya (Spain, 2001) and Ingénieur des Arts et Manufactures from the École Centrale Paris (France, 2001). He received his Ph.D. degree (summa cum laude) in Environmental Engineering from the Universitat Politècnica de Catalunya in 2006. Spanish and Catalan are his native languages and he is fluent in English and French. His research interests range from understanding the physical and chemical processes controlling atmospheric dust at multiple time scales, to evaluating its effects upon climate, ocean biogeochemistry, air quality and health. He is also a model developer with large experience in supercomputers and operational forecasting. He has co-authored 50 peer-reviewed papers, 28 chapters in books, proceedings and reports, 130 presentations at conferences, workshops and seminars, and has edited a book of proceedings. He has organized conferences and workshops on SDS and their effects, and serves as PI in multi-institutional research projects funded by DoE, NASA and NOAA. He was a member of the writing team of the Implementation Plan for an International Sand and Dust Storm Warning System of the World Meteorological Organization in 2007.

Dr Pérez García-Pando has contributed fundamentally to the field in multiple ways: 1) he proved that the inclusion of dust aerosol as a radiatively active substance in numerical weather prediction models can significantly improve short-term weather forecasts over dust affected areas like the Mediterranean region, inspiring a number of studies thereafter; 2) he led an international multi-institutional project to develop a unified prediction model for weather, atmospheric aerosols and chemistry that today provides operational forecasts at the Barcelona Dust Forecast Center; 3) he led a multi-institutional cross-disciplinary research effort to unravel the links between dust aerosols, climate and meningitis epidemics in Africa that showed the potential of models to forecast risk of meningitis epidemics, and 4) he has proposed novel semi-empirical and theoretical methods to constrain the mineral and chemical composition of dust in order to improve current estimates of dust aerosol effects upon climate and better constrain the deposition of bioavailable iron from dust in the ocean.

Dr Pérez García-Pando initiated the SDS research line at the BSC-CNS in 2006. The development of the NMMB/BSC-CTM, the forecast model he conceived and initially developed, is key to the success of the SDS program at the BSC-CNS. His work and leadership at the BSC-CNS led to an internationally recognized dust modeling group and played a seminal role for the establishment and successful operation of the WMO Regional Centers at the BSC-CNS. In 2009, Dr Pérez García-Pando moved to the US where he has held research positions at the National Centers for Environmenal Prediction (NOAA/NCEP), focusing on short- and medium-range dust and weather forecasting; the International Research Institute for Climate and Society (IRI), focusing on the impacts of climate and dust aerosols upon infectious diseases in North Africa; and the NASA Goddard Institute for Space studies (NASA GISS) and Columbia University, focusing on the mineral and chemical composition of dust aerosols and their effects at longer (climate) time scales.

His highly qualified and broad expertise in the field makes him a unique asset to lead the ambitious and cross-disciplinary activities of the AXA Chair program. The time is ripe for his comprehensive SDS research vision to produce an outstanding return to society and the BSC-CNS recognizes that it will be hard to find itself in such a unique position to capture this kind of talent and profile in the near future.

A 5-page CV is included in the Appendix. A more complete version of his CV is part of the application package.

**OTHER CONTRIBUTORS**

The governance and structure of the Chair and the role of other contributors within the BSC-ES is described in Section 5 of this application. Here, we provide a brief biography of each of the contributors. The 5-page CV's of these contributors are available in the Appendix.

**Prof. Dr Doblas-Reyes** is the Director of the BSC-ES. He started working on climate variability at the Universidad Complutense de Madrid (Spain) in 1992, where he obtained his PhD. He then worked as a postdoc in Météo-France (Toulouse, France), at the Instituto Nacional de Técnica Aerospacial (Torrejón, Spain) and for ten years at the European Centre for Medium-Range Weather Forecasts (Reading, UK). He leads the largest FP7 project on climate prediction. He is author of more than 100 peer-reviewed papers, member of several international scientific committees and supervisor of three PhD students. His research

interests focus on climate prediction, which aims at predicting the variations of climate at different time scales, ranging from one month to several years beyond the start of the forecast. He uses an Earth system model based on differential equations to explore the limits of the forecast quality over different parts of the globe, in particular over Africa, South America and Southern Europe, and statistical techniques to adapt the resulting climate information to specific user needs. Improving the application of this climate information to different socio-economic sectors, with a special focus on energy and disaster risk management, is his final objective.

**Dr Oriol Jorba** is the group leader of the Atmsopheric Composition Group at the BSC-ES. He is an Industrial Engineer from the Technical University of Catalonia (Spain, 1999) and Ph.D. in Environmental Engineering from the Technical University of Catalonia (Spain, 2005). His research activities and interests have included high resolution mesoscale meteorology and air quality, development of online meteorology-chemistry models, boundary layer studies, chemical mechanisms and environmental impact assessment. In 2005, he was enrolled as researcher at the Earth Sciences Department of the Barcelona Supercomputing Center. He has held visiting positions at the University of California Irvine (USA) in 2011, and at the NASA Goddard Institute for Space Studies (USA) in 2013. He has co-authored 30 papers in international scientific journals and over 80 communications to international conferences. He has participated in several Spanish and European projects of the FP5 and FP7 Framework Programme. He has been the principal investigator of the Spanish research project CGL2008-02818, and he now coordinates the development of the multiscale chemical weather forecasting system NMMB/BSC-CTM. He is member of the management committee of 2 European COST Actions (ES1002, ES1004) as a Spanish representative, and of the Scientific Committee of the International Technical Meeting on Air Pollution Modelling and its Application.

**Dr Virginie Guemas** is the group leader of the Climate Prediction group of the BSC-ES. Her expertise is in Arctic research, although she has been involved in numerous research studies of coupled ocean-atmosphere climate variability. She leads the Spanish MINECO-funded PICA-ICE project and is the PI of one work package of the H2020 PRIMAVERA project. Besides, she collaborates with a large number of research institutes around Europe and North America. She is the first Spanish representative ever in the Scientific Steering Group of the CLIVAR project of the World Climate Research Programme. She is author of more than 30 peer-reviewed articles, including 20 where she is first author, and one published in Nature Climate Change. She was awarded the 'Prix Adrien Gaussail' from the Académie des Sciences de Toulouse in 2010, for her PhD 'Role of the marine surface in the summer intraseasonal variability in the North-Atlantic/Europe region'.

**Dr Sara Basart** is Bachelor in Physics (2005) and Master in Science in Meteorology (2008) from Barcelona University (Barcelona, Spain). She obtained her PhD degree in Engineering Environmental (Degree of European Doctor) at Technical University of Catalonia (UPC) in January 2012 while doing her research at different research centers in Spain (like the Izana Atmospheric Research Center of the Meteorological State Agency of Spain, CIAI-AEMET) and France (Laboratoire des Sciences du Climat et de l'Environnement, LSCE/IPSL and Laboratoire de Météorologie Dynamique, LMD). At present, Dr Basart is postdoctoral researcher at the BSC-ES. Her main research background covers mineral dust modelling, air quality and aerosols. She is also member of the WMO Regional Centers and collaborates in national and international projects as the "Monitoring Atmospheric Composition & Climate (MACC)" FP7 European Project, the International Cooperative on Aerosol Prediction (ICAP) initiative, desert-dust Impact on Air quality through model-Predictions and Advanced Sensors ObservatioNs (Diapason) Project from Institute for Atmospheric Science and Climate of the National Research Council of Italy (CNR–ISAC), CV-Project (Aveiro University, Portugal) and Chemistry-Aerosol Mediterranean Experiment (Charmex) project. In addition to her research activities, she is responsible of the maintenance of aerosol ground-based remote sensing stations (AERONET sunphotometer and MPL Lidar) in Barcelona as well as in the operational implementation of new and reliable dust forecast products of the BSC-DREAM8b and NMMB/BSC-Dust models. She has co-authored more than 20 publications in scientific and technical journals as well as 70 international and national conferences.

**Dr Enza di Tomaso** has a degree in Physics from the University of Bologna in Italy, and a PhD in Engineering Mathematics from the University of Bristol in UK, where she has also worked as Lecturer in Artificial Intelligence and Discrete Mathematics before moving to the field of atmospheric science. She has then worked at the European Centre for Medium-Range Weather Forecasts in Reading, UK, a world-leading institute for numerical weather prediction where she has acquired skills for support, development and research in an operational environment implementing operational changes in the ECMWF Integrated Forecast System (IFS). Since 2013 she is a postdoc at the BSC-ES where she has recently enhanced the in-house developed chemical transport model with mineral dust data assimilation capability with the aim to improve the operational forecast and to provide reanalysis products.

**Dr Louis-Philippe Caron** joined the Climate Forecasting Unit (CFU) of the Catalan Institute of Climate

Sciences as a post-doctoral fellow in late 2013. His work mainly focuses on the long-term (seasonal to multi-annual) predictability of tropical cyclones as well as the interaction between the climate and these storms. Since his arrival, he has established a number of collaborations, notably with NCAR (USA), Columbia University (USA), the Met Office (UK), SMHI (Sweden) and UQAM (Canada). He is currently holding a research grant from the Spanish Government (MINECO) to investigate hurricane predictability.

**Dr Maria Gonçalves Ageitos** is a Chemical Engineer (Santiago de Compostela University) and Ph.D. in Environmental Engineering (UPC, 2009). Her research activities and interests range from air quality modelling, atmospheric chemistry, air quality management with a focus on urban areas and environmental impact assessment, to regional climate modelling and dynamic downscaling of climate projections for decision-making. She works as a professor in the Engineering Projects Department of the UPC since 2005, and collaborates as an associate researcher at the BSC-ES since 2009. She conducted post-doctoral research projects at the University of California Irvine (USA) – 6 months stay, 2010- and the Norwegian Meteorological Institute (Norway) – 3 months stay, 2015-. She has co-authored 12 papers in international scientific journals and over 20 communications to international conferences. She has participated in different Spanish projects on the atmospheric modelling field within the BSC-ES group (i.e. the CALIOPE project) and collaborated in technology and knowledge transfer projects with different companies (Gas Natural, Solvay Iberica) and institutions (i.e. the Catalan Meteorological Service).

**Enric Terradellas** is the Technical Director of the WMO Regional Center based at the BSC-CNS. The Technical Director is the responsible of the Center website, data exchange and research coordination in the regional node and capacity building. Enric Terradellas is also the Technical Director of the Barcelona Dust Forecast Center. The Center, also jointly managed by AEMET and the BSC-CNS, has been designated by the WMO as the first Regional Specialized Meteorological Center. The Technical Director is the responsible of the production, dissemination and archive of daily dust forecasts for Northern Africa, Middle East and Europe, generation of technical documentation and capacity building.

**Dr Albert Soret Miravet** has been working in atmospheric science for 9 years. He is currently the Earth Science Services Group co-leader at the BSC-ES. The aim of the group is to facilitate technology transfer of state-of-the-art research to advance sustainable development in key sectors such as renewable energies. He studied Chemical engineering and conducted his PhD Thesis in Environmental Engineering at the Polytechnic University of Barcelona. He also worked in an environmental agency before joining BSC. His research activities and interests have included high resolution mesoscale meteorology and climate. He is member of different climate change discussion groups. He has been involved in several national and international research projects. He has co-authored 17 publications in scientific and technical journals as well as 20 international and national conferences.

**Kim Serradell** is Bachelor (2005) in Computer Sciences for the Facultat d'Informàtica de Barcelona (FIB-UPC) and for the Grande Ecole publique d'ingénieurs en informatique, mathématiques appliquées et télécommunications de Grenoble (ENSIMAG). Since 2014 is also Master on High Performance Computing from the Facultat d'Informàtica de Barcelona (FIB-UPC). Currently, he is the co-leader of the Computational Earth Science Group at the BSC-ES. The Computational Earth Science Group is a multidisciplinary team of 12 members with different IT profiles that interacts closely with all the other groups of the Earth Sciences Dept. The group has among its tasks providing help and guidance to the scientists with the technical issues related to their work and developing a framework for the most efficient use of HPC resources. In the last years, he has been in charge for the system administration of all the computational resources of the department and he was also responsible of supervising the operational runs of the NMMB/BSC-Dust model and CALIOPE Air Quality System in the HPC infrastructures of the BSC-CNS. In that sense he was also involved in the analysis of the models to improve their performance and developed strong skills of compilation and scripting. In March 2014, he wrote his Master Thesis in the “Analysis, Developments and optimizations on the NMMB/BSC model”, centering his research applying many different techniques to improve the model performance in an HPC environment. Analysis tools like Scalasca, Paraver or Dimemas are used usually during his daily work. Furthermore, he's focused in deploying different earth system models (dust transport, climate or weather forecast) required by the department in a wide range of HPC architectures. He succeed porting different these models in next HPC architectures like Montblanc cluster (ARM Based). He applied with success these skills in projects like IS-ENES, SDS-WAS or CONSOLIDER.

**Melanie Davies** undertook research in environmental sciences before she moved to the renewable energy sector in 2004. She has worked in different companies and she currently works at the Earth Sciences Department of the BSC-CNS as the Services group co-leader. As project manager in EU funded projects, she has been focused in Climate services development to bridge the gap between climate research being developed by scientists and the needs of stakeholders and users. Her mission is to facilitate the stakeholders' access to climate information suited to particular decision-making, as well as practical guidance on how to use it.

**Dr Isadora Christel Jiménez García** has a Master's degree in Science communication and a Ph.D in offshore wind energy Impact assessment. Eight years of research experience in direct contact with wind energy stakeholders. As a science communication specialist she gives support to the BSC-ES to stimulate interest from potential end users in the department's research. As part of European Funded projects she is involved in dissemination actions, public engagement activities and the interaction with stakeholders.

**Renata Giménez Binder** has more than ten years of experience in International Marketing and Communication. Her experience includes managing European Marketing projects at Cambridge University Press as well as at Deutsche Bank. She joined BSC in 2005 as Marketing and Communication Manager, managing the corporate image, PR, merchandising and events of the center. She has also has been involved in the dissemination of European projects since 2008 (DEISA, PRACE, EESI, HPC-Europa, Mont-Blanc). She has a Master's Degree in Marketing Management from the Universitat Pompeu Fabra.

## 3. Major responsibilities of the AXA Chair holder and other contributors to the AXA Chair research program if any

| Researcher's first name and last name | Status (e.g.: chair holder, visiting professor, etc.) | (if applicable) Estimated number of teaching hours (per week, month, or year) | Role in the Chair |
|---|---|---|---|
| Dr Carlos Pérez García-Pando | Chair Holder | Not Applicable | Chair Holder |
| Dr Francisco Doblas-Reyes | Earth Science Department Director | Not Applicable | Collaborator * |
| Dr Oriol Jorba | Group Leader Atmospheric Composition Group | Not Applicable | Collaborator * |
| Dr Virginie Guemas | Group Leader Climate Prediction Group | Not Applicable | Collaborator * |
| Dr Sara Basart | Postdoc researcher | Not Applicable | Collaborator * |
| Dr Enza di Tomaso | Postdoc researcher | Not Applicable | Collaborator * |
| Dr Lois-Philippe Caron | Postdoc researcher | Not Applicable | Collaborator * |
| Dr María Gonçalves | Associate professor | 8 hours per week | Collaborator * |
| Enric Terradellas | AEMET researcher affiliated to BSC-CNS. | Not Applicable | In charge of the WMO SDS Regional Centers |
| Francesco Benincasa | AEMET technician affiliated to BSC-CNS | Not Applicable | In charge of the technical operation of WMO SDS Regional Centers |
| Kim Serradell | Computational Earth Science Group co-leader | Not Applicable | Collaborator * |
| Dr Albert Soret | Earth Science Services Group co-leader | Not Applicable | Collaborator * |
| Melanie Davis | Earth Science Services Group co-leader | Not Applicable | Collaborator * |
| Dr Isadora Christel Jiménez García | Communications and project manager at the BSC-ES | Not Applicable | Collaborator * |
| Renata Giménez Binder | Marketing and Communication Manager at the BSC-CNS | Not Applicable | Collaborator * |

* Section 5 (**Figure 8**) indicates the focus areas that will benefit from their work

# 4. AXA Chair's budget

The costs listed below correspond to the expenses associated per year (the duration of the AXA Chair is 20 years)

**Annual Financial costs (estimate)**

| | |
|---|---|
| Salaries | € 293 500 |
| Travels, Meetings, Other costs | € 115 000 |
| **TOTAL ANNUAL BUDGET** | **€ 408 500** |

72% of the total budget will be allocated in salaries of top level researchers, and 28% will go for meetings, travels, conferences and their fees and other costs associated with the development of the tasks.

**Annual Financial sources**

| | |
|---|---|
| Contribution from AXA | € 120 000 |
| Contribution from the institution | € 168 500 |
| Contribution from other sources | € 120 000 |
| **TOTAL ANNUAL BUDGET** | **€ 408 500** |

The host institution will give support to the Chair Holder with not only access to an Office in the same area as the other members of Earth Department at the BSC, in Edifici Nexus II, 29th Jordi Girona Street, Barcelona, but also to all the equipment necessary to develop his work properly. He will also have access to the services provided by:

- Project Management Office: includes assistance in the proposal preparation for all kinds of private/public grants, both national and international, agreements with other research centers or private bodies, information of funding opportunities related to his research area, support during the proposal and report periods for all the projects.
- Technology Transfer Manager: includes orientation and help for developing contracts, agreements and new opportunities (Patents, start-up, etc.) related to his activities.
- Communications Team: includes assessment on outreach activities, organization of events and press released related to his research area.
- Legal assessment: BSC has an agreement with an external office that gives advice on legal issues.
- HR Excellence in Research: The BSC started in 2014 the process for obtaining the logo "HR Excellence in Research" which identifies the institutions and organisations as providers and supporters of a stimulating and favourable working environment.
- Financial department: includes assessment on financial issues.
- Education and Training: BSC has a dedicated unit and is committed to provide Principal Investigators and their research teams with high quality training in both scientific and technical and other skills.
- Operations: BSC-CNS has hosted unique high performance computing facilities since its inception in 2006. All the computational resources managed by the center will be available for the Chair holder candidate to carry out his research plan. Currently, BSC-CNS has the following supercomputing infrastructures:
    - The MareNostrum III, a supercomputer based on Intel SandyBridge processors, iDataPlex Compute Racks, Linux Operating System and Infiniband interconnection. It has a total of 48,896

cores, a peak computing power of 1017 TFlops/s and was ranked the 29th world's fastest supercomputing facility on June 2013 by the Top500 list.

- The MinoTauro supercomputer (3 TB ram, 182.9 Tflops peak), which combines traditional CPU cores with GPU accelerators, is also hosted at the BSC-CNS facilities. It was ranked the 442th fastest machine in the world on June 2013.
- BSC-CNS has strong connections with other international supercomputing centers, like the German Jülich Supercomputing Center, the US Lawrence Livermore and Argonne National Laboratories or the Japanese Tokyo Institute of Technology. Therefore the Chair holder could perform simulations in the most powerful high performance machines of the world.

- BSC-CNS has also a highly skilled and well-trained support team of technicians able to provide advice and support to the scientists that use the available high performance computing infrastructures. The combination of outstanding available supercomputing facilities and high quality user support will provide the Chair holder with a very strong basis in terms of infrastructure.

**Other existing or planned funding partners for this AXA Chair ( if applicable )**

| Name of other funding partners | Date of their financial commitment | Financial commitment (amount in euros) |
|---|---|---|
| AEMET* (already contributor through BSC-CNS) | From 2015 | 30,000€/year * |
| National and European sponsored projects | From 2016 | Between 20,000 and 100,000 € |
| US: NASA, DoE (Department of Energy), NOAA (National Oceanic and Atmospheric Administration), NSF (National Science Foundation) | From 2016 | In kind contribution**<br>(co-mentoring PhD students or Postdocs) |

*AEMET is the National Meteorology Agency in Spain, and through an agreement set in 2013, this institution provides (especially as salaries contribution) up to 200,000€/year to the BSC-CNS.

**Dr Perez García-Pando has ongoing projects with DoE, NASA and NOAA. If he is awarded with the Chair he will become AXA Professor at the BSC-CNS. He would also keep an adjunct (unfunded) position at Columbia University and NASA. This would allow him to serve as a bridge between the SDS research carried out in both continents. He would be able to reinforce several focus areas within the AXA Chair program by co-mentoring PhD students and postdoctoral researchers with his US collaborators. He would also increase the visibility of the AXA Chair program in the US.

# 5. Partnership implementation

## STEERING COMMITTEE OF THE AXA CHAIR ON SDS

The AXA program on SDS will be supervised by a Steering Committee (AXA Chair SC). The basic role of the AXA Chair SC will be to ensure the fulfillment, consistency and evolution of the AXA Chair program goals over the years. The Chair of the SC will be the AXA Chair holder and the other members will be the Earth Sciences Department Director of the BSC-CNS (currently Dr Doblas-Reyes), the Chair of the WMO SDS-WAS Steering Group (currently Slobodan Nickovic), and two external collaborators and world-class experts on SDS (Ron Miller from NASA, and Paul Ginoux from NOAA GFDL). The AXA Chair SC will meet formally on an annual basis via teleconference. Another member designed by AXA will be invited to the meetings to monitor the progress of the program.

## DETAILED STEPS OF THE IMPLEMENTATION OF THE PARTNERSHIP

### Planning

This 20-year research program will be structured into detailed implementation plans every 3-years. Every 3-year implementation plan will include a description of the activities and achievements of the previous period and the definition of specific milestones and deliverables for the following 3-year period. In addition, there will be an annual report that will be available publicly through a dedicated AXA Chair web site within the BSC-CNS portal.

### Monitoring context and adjusting the program approaches

The members of the AXA Chair SC will revise, evaluate, and provide recommendations for the implementation plan proposed by the AXA Chair holder. At the end of each 3-year period, the Steering Committee will evaluate the activities and accomplishment of the goals and a report will be sent to AXA for further evaluation. Intermediate reports and evaluations will happen on an annual basis to assure the correct evolution and schedule of all the activities and their relevance to the Strategic Goals of the AXA Chair program.

## GOVERNANCE OF THE AXA CHAIR

Dr Pérez García-Pando would become AXA Professor and co-leader of the Atmospheric Composition Group at the BSC-ES. He would depend directly of the Director of the Earth Science Department. He will coordinate and lead the activities of the program and will work transversally in coordination with the group leaders and members of the different research groups as displayed in **Figure 9**.


**Figure 9.** Members of the research groups contributing to the different focus areas and coordinated by the AXA Chair holder (colours indicate the research group).

## FRAMEWORK PROPOSED TO ENCOURAGE INTERACTIONS BETWEENS AXA AND ACADEMICS

To encourage interactions between the AXA Chair Holder and AXA, we propose establishing yearly meetings, where an AXA representative and the Chair Holder can discuss the development of the research, the path chosen for each goal and the future steps to ensure the correct development, and the alignment with AXA main research interests.

## CAPACITY BUILDING, TECHNOLOGY TRANSFER, DISSEMINATION AND PUBLIC ENGAGEMENT

Promoting SDS knowledge, enhancing dissemination, technology transfer and capacity building is a core strategic goal of the AXA Chair program on SDS. This strategic goal follows the other four strategic goals detailed in the Description section of this application:

### Strategic Goal 5: To promote SDS capacity building, technology transfer, dissemination and public engagement

The purpose of this Strategic Goal is to achieve the expected social impact of the AXA Chair program. In order to reach the full potential in each of the previous goals, the results and products developed within the project must reach all target audiences defined below. The main objectives within Strategic Goal 5 will be:

- To disseminate the project ideas, results and products adapting the message or content to each audience ranging from the scientific community involved in weather, climate and atmospheric chemistry to industry stakeholders, Government, policy-makers and general public.
- To engage with all the interested parts, to receive end-user feedback and interaction, promote capacity building and project co-design according to the real needs of the sectors affected by SDS.
- To generate public engagement in relation to the potential impacts of SDS.

Dissemination actions will be divided in four focus areas aimed to the four major audiences interested in the AXA chair outcomes: the scientific community, the industry sectors whose activities are affected by SDS, national weather services and decision-makers, selected targets within the general public.

**Focus area 5.1. Scientific community.** The basic research results derived from strategic goals 1, 2 and 3 will be disseminated, shared and discussed within the scientific community of climate, weather and SDS experts. Regarding Strategic Goal 4, a special effort will be done to promote the interaction with researchers from other disciplines, health scientists and engineers for instance, to explore the implications of SDS in their fields.

One of the main dissemination actions within this focus area will be the organization in Barcelona of a biannual scientific conference on SDS. This conference will be an opportunity to disseminate project results, discuss the latest advances in the topic with our scientific collaborators, interact with other worldwide experts, and give visibility to the AXA Chair activities.

During the last years, the WMO Regional Center and more recently the BDFC have coordinated a series of training courses and seminars mainly targeted to operational meteorologists from National Meteorological and Hydrological Services from Northern Africa and Middle East. The events have also been eventually attended by PhD students and post-doctoral researchers interested in atmospheric composition and/or solar radiation. The syllabuses include the dust cycle and impacts, ground and satellite observation, dust modelling and forecast as well as information on available observational and forecast products. Different institutions have contributed to finance the events: WMO, EUMETSAT, AEMET, BSC, Turkish state Meteorological Service, Catalonia Technical University, Directorate General of Meteorology and Air Navigation of Oman, Sultan Qaboos University and National Meteorology Direction of Morocco. Through this channel the AXA Chair will be able to disseminate the latest advances in research to this audience.

**Focus area 5.2. Industry.** Strategic Goals 3 & 4 will provide tactical and strategic applications of interest to technical non-academic audiences. It is crucial the close interaction with the industry stakeholders to engage their interest in these applications and promote the inclusion of the AXA Chair products to their decision-making processes or impact mitigation procedures.

The main goal will be to become a reference source of technical information on SDS for strategic decisions of industry stakeholders by releasing a biannual report with technical information on SDS in the world. The goal is to give visibility to the AXA chair project among stakeholders and later engage them in an active dialog to define the right prediction products and information needed for operational decisions.

**Focus area 5.3. National Meteorological Services and decision-makers.** Strategic Goal 4 focuses on the assessment of SDS impacts upon key sectors of society and economy. The National Meteorological and Hydrological Services (NMHSs) are main agents in the provision of local information related to SDS events

and therefore it is a priority to foster technology transfer and capacity building within this sector, particularly in the least developed countries.

Some examples of products that the BSC-CNS already disseminates through the BDFC are regional forecasts of the NMMB/BSC-CTM model. These forecasts are provided continuously throughout the year on a daily basis and include several products (dust load, surface concentration and extinction, optical depth, wet and dry deposition). Forecasts cover the period from the starting forecast time (12 UTC) up to a forecast time of 72 hours, with an output frequency of 3 hours. They cover Northern Africa (north of equator), Middle East and most of Europe and the forecast products are provided on the web portal http://dust.aemet.es. Most of the forecasts are also disseminated in pictorial form through the WMO Global Telecommunication System. There is a recent agreement between the BDFC and EUMETCAST to disseminate the dust forecasts through the EUMETCast service. EUMETCast is a multi-service dissemination system based on standard Digital Video Broadcast (DVB) technology. This is particularly important in areas with deficient internet connections such as Africa, because it uses commercial telecommunication geostationary satellites to multi-cast files (data and products) to a wide user community.

To further reach this audience we will carry out a series of thematic workshops (SDS and transport, health, energy, etc.) accompanied with training on the products and outcomes of the program's impact research. An example is the 1st SDS-WAS Africa/Middle-East Workshop - currently in preparation- on the health Impact of Airborne Dust. This workshop is in collaboration with WMO, WHO, UNEP and AEMET. The main objective is to promote active communication among dust-related service providers, African/Middle-Eastern National Meteorological and Hydrological Services and relevant national and international air quality and public health agencies. An outcome of the workshop will be a set of recommendations addressed to policy-makers, managers, service providers and researchers aimed at raising awareness of the adverse impacts of airborne dust and designing and implementing mitigation measures.

**Focus area 5.4. General public.** It is necessary to have an impact in the public debate and give more visibility to SDS and their impacts. Ensuring that the general public understands this phenomenon along with the economic and human impacts will be decisive to a successful deployment of the risk assessment and impact mitigation tools addressed in the AXA Chair. For a successful communication impact in general audiences it is necessary to define small segments of the general public to tailor the communication actions. Mainstream press releases will be prepared for general media. We will also cooperate with AXA to disseminate Dr Pérez Garcia-Pando's discoveries through AXA's worldwide network to enrich the public's scientific knowledge. We will pay a special attention to tailored press releases and pieces of writing for specialised blogs and on-line media. Likewise, public engagement activities will be addressed to segments of society, particularly those interested in the state of air quality, either because they are susceptible to cardio-respiratory diseases, have small children, make outdoor sports activities or because they simply care about the air we breathe.

**Draft communication plan**

As this is a long-term program, this Strategic Goal will be defined in a "Dissemination and public engagement strategy document" that will become a life document revised every three years to define the communication actions and adapt the plan to the evolution of the communication channels and the perceptions of the topic in the target audiences. Below there is a summary table with a list of potential actions that could be used to reach the target audiences and stimulate public awareness on SDS:

| | Dissemination action | Type | Impact |
|---|---|---|---|
| 1 | Biannual scientific conference | Knowledge transfer | - Inform on project results<br>- Feedback on project development |
| 2 | Assistance to scientific conferences | Knowledge transfer | - Inform on project results |
| 3 | Scientific publications | Knowledge transfer | - Inform on project results |
| 4 | On-line training | Knowledge transfer and capacity building | - Inform on project results<br>- Feedback on project development |
| 5 | Printed and multimedia materials for trade fairs, conferences and workshops | Dissemination material | - Raise awareness about project and Brand recognition<br>- Inform on project results |

| | | | |
|---|---|---|---|
| 6 | Thematic workshops (SDS and health, transportation, energy, etc.) | Knowledge transfer and capacity building | - Inform on project results<br>- Feedback on project development |
| 7 | Biannual technical report (relevant data for the industry sector, e.g. number of SDS by country, estimation of economic damages, etc.) | Dissemination material | - Raise awareness about project and Brand recognition<br>- Inform on project results |
| 8 | Networking event with large firms and SME of sectors interested in SDS | Knowledge transfer and capacity building | - Raise awareness about project and Brand recognition<br>- Inform on project results |
| 9 | Website (AXA Chair section launch in the BSC-CNS website and the AXA website) | Website | - Platform to disseminate project results |
| 10 | Focus groups with stakeholders to adjust project development to the end-user needs | Project co-design | - Feedback on project development |
| 11 | Facebook and twitter activity through BSC-CNS and AEMET accounts | Social networks | - Inform on project results |
| 12 | Opinion and review pieces on SDS written by the AXA Chair holder | Specialized on-line media | - Raise awareness about the project<br>- Inform on project results |
| 13 | Press releases | Press | - Inform on project results |
| 14 | MareNostrum visits (Open days) | Knowledge transfer | - Raise awareness about project<br>- Inform on project results |
| 15 | Museographic project to be exhibited in science museums or other museums/halls | Knowledge transfer and capacity building | - Raise awareness about project<br>- Inform on project results |

# 6. Replacement of the AXA Chair holder and evolution of the AXA Chair

## Recruitment process

In case we may need to start a recruitment process for the position of AXA Chair holder, we will follow the following procedure: A Recruitment Panel will be formed by the other members of the Steering group of the AXA Chair (BSC Earth Sciences Department Director, Chair of the Steering group of the WMO SDS-WAS, and two external SDS experts), and the two Earth Science experts of the Scientific Advisory Board of the BSC-CNS. They will be involved in the recruitment cycle (with the support of Human Resources), which includes job description definition, dissemination, CV screening, interviews and final decision in coordination and agreement with AXA.

## Evolution of the AXA Chair program

The evolution of the AXA Chair program will be managed by the AXA Chair SC. One of the members of the AXA Chair SC will be the Chair of the WMO SDS-WAS Steering Committee. The WMO SDS-WAS releases implementation plans every several years after consultation will a large community of experts. This scheme will ensure the consistency and relevance of the AXA Chair program over the years. The Chair holder and the other members of the AXA Chair SC will align and reformulate the Strategic Goals and focus areas taking into account the scientific advances and the evolution of user needs over the years.

# 7. Host institution

The Barcelona Supercomputing Center-Centro Nacional de Supercomputación (BSC-CNS) was established in 2005 and is the Spanish National Supercomputing facility and a hosting member of the PRACE distributed supercomputing infrastructure. The Center houses MareNostrum, one of the most powerful supercomputers in Europe. The mission of BSC is to research, develop and manage information technologies in order to facilitate scientific and societal progress. The BSC-CNS also hosts other high-performance computing (HPC) systems such as MinoTauro, one of the most energy efficient supercomputers in the world.

BSC-CNS was a pioneer in combining HPC service provision, and R&D into both computer and computational sciences (life, earth and engineering sciences) under one roof. The center fosters multidisciplinary scientific collaboration and innovation and currently has over 350 staff from 41 countries. In 2011, BSC was one of only eight Spanish research centers recognized by the national government as a "Severo Ochoa Centre of Excellence". Recently the center obtained the Human Resources Excellence in Research logo.

BSC-CNS has collaborated with industry since its creation, and has participated in projects with companies such as ARM, Bull and Airbus as well as numerous SMEs. BSC-CNS also participates in various bilateral joint research centers with companies such as IBM, Microsoft, Intel, NVIDIA and Repsol. The center has been extremely active in the EC Framework Programmes and has participated in seventy-nine projects funded by it. BSC is a founding member of HiPEAC, the ETP4HPC and participates in the most relevant international roadmapping and discussion forums and has strong links to Latin America.

In 2014, BSC-CNS created a Technology Transfer Manager position, to help the researchers to reach industry through their research. Besides, all the support to research team, including Project Management Office, and the synergies between departments, Computer Sciences, Life Sciences, Earth Sciences and Computational Applications in Science and Engineering create a multi-disciplinary approach. The combination of world-leading researchers and HPC experts with state-of-the-art HPC resources make BSC-CNS a unique research institution. Education and Training is a priority for the center and many of BSC-CNS's researchers are also university lecturers. BSC-CNS offers different courses, such as a PRACE Advanced Training Centre, and others through the Spanish National Supercomputing Network. On top of that, one of the main goals of the center is to create an environment of Excellence, being able to create high level online courses for researchers and the public all over the world.

**Earth Sciences Department (BSC-ES)**

The Earth Sciences department is composed of four different but closely interacting research groups:

The **Atmospheric Composition Group** has a wide experience in high-resolution atmospheric and chemistry modelling and leads an international effort on the development of a multi-scale chemical weather prediction model called the NMMB/BSC-CTM. The group operates the well-known CALIOPE forecast system, which delivers publicly air quality forecast products with high resolution (12 km for Europe, 4 km for Spain, 1 km for hot spot urban areas). The aim of the group is to improve chemical weather forecasts (up to 10 days) from local to global scales, while expanding our understanding of the chemical composition of the atmosphere and its effects upon air quality, weather and climate. This involves (and is not limited to) the continuous development of the in-house NMMB/BSC-CTM model with aerosol schemes and chemistry mechanisms adapted for local, regional and global scale forecasting, the implementation and improvement of data assimilation techniques for model initialization, and the understanding of processes such as aerosol-radiation-cloud interactions. A core activity of the group is Sand and Dust Storm modelling and forecasting from regional to global scales, and as a result of its excellence, the BSC-CNS hosts both the WMO SDS-WAS NA-ME-E and the WMO RSMC-ASDF, in a close and successful collaboration with AEMET, the Spanish meteorological agency.

The **Climate Prediction Group** is mainly composed by the newly merged IC3-CFU component. The group has undertaken research on the development of dynamical and statistical methods for the prediction of global and regional climate on time scales ranging from a few weeks to several years, and on the assessment of sources of predictability and processes at the origin of model error. The aim of the Climate Prediction Group is to implement the most efficient climate prediction system covering time scales ranging from a month to a few decades (subseasonal-to-decadal climate prediction) at global and regional scales, while expanding our understanding of the climate system. This involves (and is not limited) to the implementation and testing in the EC-Earth modeling system of new model components (e.g. biogeochemistry, vegetation, aerosols, new alternative sea ice model) and sub-grid cell parameterizations (e.g. ocean mixing, sea ice and snow cover surface scheme for albedo, soil hydrological cycling), the generation of ground-breaking high-resolution climate predictions, the improvement of data assimilation and initializations techniques, the understanding of sources of predictability, and the diagnosis of climate forecast

weaknesses. This new expertise within the Department will allow a comprehensive coverage of SDS phenomena and predictions by extending the current scope of the SDS activities from weather to climate scales.

The BSC-ES also intends to bridge the gap between Earth System science and its end users in key sectors of society (energy, urban development, infrastructure, transport, health and agriculture) via tailored services. Non-profit services are developed in-house (weather and atmospheric composition forecasting, and climate predictions) via projects in collaboration with public administrations, private contracts with companies or funding agencies, and spin-off companies that could exploit operational opportunities. This is the duty of the **Earth Sciences Services Group** whose aim is to quantify the impact of weather, climate, aerosols and gaseous pollutants upon socio-economic sectors through the development of user-oriented services that ensure the transfer of the technology developed and the adaptation to a rapidly changing environment, especially of those highly vulnerable. The Earth Science Services Group aims at identifying user needs that will partly guide research in the BSC-ES, and creating, in collaboration with support groups at the BSC-CNS (technology transfer, communications, visualization, education and outreach), user-interaction platforms to disseminate knowledge and tailored products. Therefore, the contribution of this group will be instrumental towards the end-to-end goals of the AXA Chair on SDS.

Finally, the **Computational Earth Sciences Group** is a multidisciplinary team with different information technology (IT) profiles that interacts closely with the other Department groups and the BSC-CNS Computer Sciences Department, and intends to use state-of-the-art programming models and profiling tools to prepare Earth Science models to run on next generation exascale HPC systems, while improving the efficiency of existing models, pre- and post-processing tools and operational systems, and maintaining the IT infrastructure allowing the research teams to accomplish their objectives. This area will take advantage of the unique environment of the BSC-CNS where research in Big Data already is a priority that will be enhanced over the next years. This group will be crucial at allowing the implementation of groundbreaking SDS high-resolution forecasts from local to global scales.

The excellence of the Department is illustrated by its high publication rate, with more than 120 papers, several of them of very high impact, during the past 5 years; the participation and/or coordination of EU-FP7, H2020 and national projects (e.g. IS-ENES, IS-ENES2, APPRAISAL, FIELDAC, ACTRIS, CLIM-RUN, QWeCi, DENFREE, SPECS, PREFACE, EUCLEIA, PRIMAVERA, CHANCE, IMPREX) and the close collaboration with the industry sector (e.g. Risk Prediction Initiatives, Mapfre, Climate-KIC). The list of collaborating institutions includes, and is not limited to SMHI, KNMI, Météo-France, LOCEAN, Univ. Reading, Univ. Exeter, ECMWF, MPI, AWI, CPTEC, NOAA, CMCC, Complutense Univ. of Madrid, CERFACS, MetOffice, UQAM, ENEA, UCL, Univ. Washington, NSIDC, CSIC, AEMET, NASA, IRI, Columbia Univ. and Univ. of California, Irvine. The groups also work closely with a number of private companies, especially in the fields of agriculture, transport and energy, among which there are Bodegas Torres, AWS Truewind, EDF, Vortex, Risk Prediction Initiatives, Sogrape Vinhos, and Meteosim, plus many more that access the operational air quality and dust products made available daily online.

# 8. Appendix

**Index of the Appendix**

- **List of acronyms**
- **References cited in the Description section**
- **Short CV of the Chair holder candidate**
- **Short CV's of other contributors to the Chair at the BSC-CNS**

## 8.1 List of acronyms

| Acronyms | Definition |
|---|---|
| ACMAD | African Center for Meteorological Applications for Development |
| ACTRIS | Aerosols, Clouds and Trace gases Research InfraStructure network |
| AEMET | Spanish Meteorological Agency |
| AERONET | Aerosol Robotic Network |
| ARECS | Advancing Renewable Energy with Climate Services |
| BDFC | Barcelona Dust Forecast Center |
| BSC-CNS | Barcelona Supercomputer Center-Centro Nacional de Supercomputación |
| BSC-DREAM8b | Updated version of the Dust REgional Atmospheric Model at BSC-CNS |
| BSC-ES | Earth Sciences Department at the BSC-CNS |
| CCN | Could Condensation Nuclei |
| CERFACS | Centre Européen de Recherche et de Formation Avancée en Calcul |
| CESM | Community Earth System Model |
| Charmex | Chemistry-Aerosol Mediterranean Experiment |
| CIAI-AEMET | Izana Atmospheric Research Center of the Meteorological State Agency of Spain |
| CLIM-RUN | Climate Local Information in the Mediterranean region Responding to User Needs |
| CMA | China Meteorological Administration |
| CMIP5 | Fifth Coupled Model Intercomparison Project |
| CNR | Centre National de Recherche Scientifique |
| CNR–ISAC | Institute for Atmospheric Science and Climate of the National Research Council of Italy |
| CONUS | Contiguous United States |
| CREAL | Center for Research in Environmental Epidemiology |
| CSIC | Spanish National Research Council |
| DGVM | Dynamic Global Vegetation Model |
| Diapason | Desert-dust Impact on Air quality through model-Predictions and Advanced Sensors ObservatioNs |
| DNI | Solar Direct Normal Irradiance |
| DNICast | Direct Normal Irradiance Nowcasting project |
| DoE | US Department of Energy |
| DREAM8-NMME-MACC | Dust Regional Atmospheric Model from SEEVCC |
| DREAMABOL | Dust Regional Atmospherci Model from University of Bologna |
| DRI | Desert Research Institute |
| DVB | Digital Video Broadcast |
| EARLINET | European Aerosol Research Lidar NETwork |

| | |
|---|---|
| EC-Earth | EC-Earth Consortium (and its Earth system model) |
| ECWMF | European Centre for Medium-Range Weather Forecasts |
| EMA | Egipcian Meteorological Agency |
| EMIT | Proposal for NASA EVI-3 in preparation with the participation of Dr. Pérez |
| ENSIMAG | Grande Ecole publique d'ingénieurs en informatique, mathématiques appliquées et télécommunications de Grenoble |
| ESA | European Space agency |
| ESM | Earth System Model |
| ETP4HPC | The European Technology Platform for High Performance Computing |
| EU | European Union |
| EUMETSAT | European Organisation for the Exploitation of Meteorological Satellites |
| EUPORIAS | European Provision Of Regional Impacts Assessments on Seasonal and Decadal Timescales project |
| EVI-3 | Earth Venture Instrument-3 |
| FIB-UPC | Facultat d'Informàtica de Barcelona |
| FNMOC | Fleet Numerical Meteorology and Oceanography Center |
| FP7 EU | FP7 EU research infrastructure project |
| GEOS-5 | Goddard Earth Observing System Model, version 5 |
| GFDL | Geophysical Fluid Dynamics Laboratory (NOAA) |
| GFS | Global Forecast System |
| GISS | Goddard Institute for Space Studies (NASA) |
| GMAO | Global Modeling and Assimilation Office |
| GSFC | Goddard Space Flight Center (NASA) |
| H2020 | European Union's Horizon 2020 |
| HiPEAC | European Network of Excellence on High Performance and Embedded Architecture and Compilation |
| HPC | High-Performance Computing |
| IC3-CFU | Climate Forecast Unit at the Institut Català de Ciències del Clima |
| ICAO | International Civil Aviation Organization |
| ICAP | International Cooperative on Aerosol Prediction initiative |
| ICG | Secretariat of the International Coordinating Group |
| ICREA | Catalan Institution for Research and Advanced Studies |
| IDAEA-CSIC | Institute of Environmental Assessment and Water Research at CSIC |
| IFS | Integrated Forecast System (ECMWF) |
| IN | Ice Nuclei |
| IPSL | Institut Pierre-Simon Laplace |
| IRI | International Research Institute for Climate and Society |
| IS-ENES | Infrastructure project of the European Network for Earth System Modeling (ENES) |
| ISS | International Space Station |
| JAXA | Japan Aerospace Exploration Agency |
| JMA | Japanese Meteorological Agency |
| JPL | Jet Propulsion Laboratory |
| KNMI | Royal Netherlands Meteorological Institute |
| LIM | Louvain-la-Neuve Sea Ice Model |
| LMD | Laboratoire de Météorologie Dynamique |

| | |
|---|---|
| LPJ-GUESS | Lund-Potsdam-Jena General Ecosystem Simulator |
| LSCE | Laboratoire des Sciences du Climat et de l'Environnement |
| LVP | Low Visibility Procedures |
| MACC | Monitoring Atmospheric Composition & Climate |
| MASINGAR | Model of Aerosol Species IN the Global AtmospheRe |
| Met Office | UK Meteorological Office |
| MetUM | Unified Model from MetOffice |
| MJO | Madden-Julian Oscillation |
| MODIS | Moderate Resolution Imaging Spectroradiometer |
| MPI | Max Planck Institute |
| NAAPS | Navy Aerosol Analysis and Prediction System |
| NAAPS | Navy Aerosol Analysis and Prediction System |
| NAO | North Atlantic Oscillation |
| NASA | National Aeronautics and Space Administration |
| NCAR | National Center for Atmospheric Research |
| NCEP | National Centers for Environmental Prediction |
| NEMO | Nucleus for European Modelling of the Ocean Model |
| NGAC | NEMS Global Forecast System Aerosol Component |
| NGGPS | Next Generation Global Prediction System |
| NMHS | National Meteorological and Hydrological Services |
| NMMB | Non-Hydrostatic Multi-scale Model |
| NMMB/BSC-CTM | Non-Hydrostatic Multi-scale Model  BSC Chemical Transport Model |
| NOAA | National Oceanic and Atmospheric Administration |
| NRL | Naval Research Laboratory |
| NWP | Numerical Weather Prediction |
| OASIS | EC-EARTH's model coupler |
| PDSI | Palmer Drought Severity Index |
| PI | Principal Investigator |
| PRACE | Partnership for advanced computing in Europe |
| RegCM4 | Regional Climate Model system version 4 from EMA |
| RSMC-ASDF | Regional Specialized Meteorological Center with activity specialization on Atmospheric Sand and Dust Forecast |
| SDS | Sand and Dust Storms |
| SDS-WAS | Sand and Dust Storm Warning Advisory and Assessment System |
| SEEVCC | South East European Virtual Climate Change Center |
| SME | Small & Medium Sized Enterprises |
| SMHI | Swedish Meteorological and Hydrological Institute |
| SPECS | Seasonal-to-decadal climate Prediction for the improvement of European Climate Services |
| SST | Sea Surface Temperature |
| TM5 | Global Chemistry Transport Model |
| TOA | Top of Atmosphere |
| TUD | Technische Universität Darmstadt |
| UB | University of Birmingham |

| | |
|---|---|
| UCAR | University Corporation for Atmospheric Research |
| UCI | University of California, Irvine |
| UCLA | University of California, Los Angeles |
| UNEP | United Nations Environment Programme |
| UNICEF | United Nations International Children's Emergency Fund |
| UPC | Technical University of Catalonia |
| WHO | World Health Organization |
| WMO | World Meteorological Organization |

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# 8.1 CV of the Chair holder candidate

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**ACADEMIC QUALIFICATIONS**

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| Ph.D. in Environmental Engineering. Universitat Politècnica de Catalunya, Spain. | 2006 |
| Summa Cum Laude (Unanimity). Advisor: Prof. José M. Baldasano | |
| Diploma of Advanced Studies. Environmental Engineering. Universitat Politècnica de Catalunya, Spain. | 2003 |
| Industrial Engineer - Environmental Option. ETSEIB (Barcelona). Universitat Politècnica de Catalunya, Spain. | 2001 |
| Ingénieur des Arts et Manufactures from the École Centrale Paris, France. | 2001 |

**PROFESSIONAL EXPERIENCE**

| | |
|---|---|
| 10/2011-present | **Associate Research Scientist -** NASA Goddard Institute for Space Studies & Department of Applied Physics and Applied Mathematics - Columbia University (New York). |
| 9/2009-9/2011 | **Earth Institute Fellow** - The Earth Institute (Fellows Program) – NASA Goddard Institute for Space Studies & International Research Institute for Climate and Society – Columbia University (New York). |
| 2/2009-6/2009 | **Visiting Scientist -** NOAA/National Centers for Environmental Prediction, Camp Springs (Maryland). |
| 1/2006-7/2009 | **Research Scientist and Mineral Dust Group Leader -** Earth Sciences Department. Barcelona Supercomputing Center (Spain). |
| 1/2005-4/2005 | **Visiting Scientist** - Mediterranean Centre on Insular Coastal Dynamics. University of Malta (Malta). |
| 9/2001-12/2005 | **Research Assistant** and PhD. Candidate **-** Laboratory of Environmental Modeling. Universitat Politècnica de Catalunya (Spain). |

**LANGUAGES**

Catalan and Spanish: Native; English: Fluent; French: Fluent

**SUMMARY**

| | |
|---|---|
| Peer-reviewed journal articles published + submitted | 50 |
| Citations (google scholar) | 1813 |
| h-index / i10-index | 23 / 34 |
| Invited talks | 26 |
| Book as Editor | 1 |
| Chapters in books, proceedings and reports | 28 |
| Presentations at conferences, workshops and seminars | 130 |
| Projects as Principal/Co-Principal Investigator | 5 |
| Projects as Co-Investigator/Collaborator | 23 |
| Conference/Workshop Organizer/Co-Chair | 4 |
| PhD, Master, Postdoc – Advisor/Sponsor | 6 |
| Institutional agreements | 5 |
| Model development (open source) + forecast systems (technology transfer/services) | 4 + 2 |
| Media appearances and Outreach | 13 |

**COMPETITIVE FELLOWSHIPS AND AWARDS**

- Earth Institute Fellowship to develop research at the NASA Goddard Institute for Space Studies and the International Research Institute for Climate and Society at Columbia University (New York) (09/2009-10/2011). The Earth Institute at Columbia University ($110,000).
- Mobility grant "José Castillejo" awarded by the Spanish Ministry of Science and Innovation for a visiting scientist position at the NOAA/National Centers for Environmental Prediction (Maryland) (02/2009-06/2009).
- PhD Fellowship from the Universitat Politècnica de Catalunya (Spain) for finalization of PhD (2003-2005).
- PhD Fellowship associated to the European Project EARLINET. (2001-2003).
- Fellowship from the Department of Project Engineering. Universitat Politècnica de Catalunya (Spain) (2000-2001).
- Fellowship to obtain the double Spanish-French Engineering degree at the École Centrale Paris (France) (1998-2000).

**SPONSORED RESEARCH PROJECTS** I have participated in 28 research projects in Europe and the United states as Co-Investigator or collaborator, and 5 research projects as Project Director (PD), Principal (PI) or Co-Principal Investigator (Co-PI). The latter are listed below:

- **PD and Institutional PI**. Department of Energy (DoE DE-SC00671). "*Improving the representation of soluble iron in climate models*". Collaborative Project between Columbia University, NASA and Cornell University. NASA-Columbia PI: Carlos Pérez García-Pando. Cornell PI: Natalie Mahowald. **$750,000** (10/2011-10/2014).
- **Co-PI**. NASA ROSES Modeling, Analysis and Prediction Program. "*Contribution to radiative forcing and climate by anthropogenic sources of dust aerosol*". PI: Ron L. Miller. Co-I's from NASA, Columbia University, Geophysical Fluid Dynamics Laboratory and Princeton University. **$1,020,000** (07/2014-07/2018).
- **Co-PI.** R2O Initiative for the Next Generation Global Prediction System (NGGPS)**,** NOAA. ***"****Implementation and testing of dust models for regional and global forecasting"*. PI: Paul Ginoux (GFDL). **$200,000** (2015-2016).
- **PI**. Earth Institute Cross-Cutting Initiative (CCI). "*Atmospheric aerosol impacts on health in sub-Saharan Africa*". **$45.000** (09/2010-to present).
- **PI**. Ministry of Science and Technology, Spain. Contract CGL2006-11879/CLI. "*Improvement of the Dust Regional Atmospheric Model (DREAM) for prediction of Saharan dust events in the Mediterranean and the Canary Islands*". **130,000 Euro**. (10/2006–09/2009).

**SELECTED PEER-REVIEWED PUBLICATIONS (out of 50)**

Google scholar citations (1813), h-index (23), i10-index (34) (as of May 20, 2015)

**10 most recent publications:**

1. Perlwitz, J.P.*, **C. Pérez García-Pando*** R.L. Miller* **(*Equal contribution),** 2015. Predicting the Mineral Composition of Dust Aerosols. Part I: Representing Key Processes. **Atmospheric Chemistry and Physics Discussions,** 15, 3493-3575 (accepted for ACP)**.**
2. Perlwitz, J.P., **C. Pérez García-Pando,** R.L. Miller, 2015. Predicting the mineral composition of dust aerosols – Part 2: Model evaluation and identification of key processes with observations. **Atmospheric Chemistry and Physics Discussions,** 15, 3577–3627 (accepted for ACP)**.**
3. Spada, M, O. Jorba, **C. Pérez García-Pando**, Z. Janjic, J.M. Baldasano (2014). On the evaluation of global sea-salt aerosol models at coastal/orographic sites. ***Atmospheric Environment***, 101, 41-48.
4. Hickman J.E., R.J. Scholes, T.S. Rosenstock, **C. Pérez García-Pando**, J. Nyamangara, 2014. Assessing non-$CO_2$ climate-forcing emissions and mitigation in sub-Saharan Africa***. Current Opinions in Environmental Sustainability,*** 9-10, 65-72, doi:10.1016/j.cosust.2014.07.010.
5. **Pérez García-Pando, C**., M.C. Stanton, P.J. Diggle, S. Trzaska, R.L. Miller, J.P. Perlwitz, J.M. Baldasano, E. Cuevas, P. Ceccato, P. Yaka and M.C Thomson, 2014. Soil dust aerosols and wind as

predictors of seasonal meningitis incidence in Niger. ***Environmental Health Perspectives*****.** doi:10.1289/ehp.1306640

6. **Pérez García-Pando, C**., M.C. Thomson, M. Stanton, P. Diggle, T. Hopson, R. Pandya, R.L. Miller and S. Hugonnet, 2014. Meningitis and climate: From science to practice. ***Earth Perspectives*** 1, 14, doi:10.1186/2194-6434-1-14
7. Miller, R.L., G.A. Schmidt, L.S. Nazarenko, N. Tausnev, S.E. Bauer, A.D. Del Genio, M. Kelley, K.K. Lo, R. Ruedy, D.T. Shindell, I. Aleinov, M. Bauer, R. Bleck, V. Canuto, Y.-H. Chen, Y. Cheng, T.L. Clune, G. Faluvegi, J.E. Hansen, R.J. Healy, N.Y. Kiang, D. Koch, A.A. Lacis, A.N. LeGrande, J. Lerner, S. Menon, V. Oinas, **C. Pérez García-Pando,** J.P. Perlwitz, M.J. Puma, D. Rind, A. Romanou, G.L. Russell, Mki. Sato, S. Sun, K. Tsigaridis, N. Unger, A. Voulgarakis, M.-S. Yao, and J. Zhang 2014. CMIP5 historical simulations (1850-2012) with GISS ModelE2. ***Journal of Advances in Modeling Earth Systems,*** doi: 10.1002/2013MS000266***.***
8. Ceccato, P., S. Trzaska, **C. Pérez García-Pando**, O. Kalashnikova, J. del Corral, R. Cousin, M.B. Blumenthal, M. Bell, S.J. Connor, and M.C. Thomson, 2014. Improving decision-making activities for meningitis and malaria. ***Geocarto International.*** doi:10.1080/10106049.2013.827749. (early on-line)
9. Spada, M., O. Jorba, **C. Pérez García-Pando**, Z. Janjic, and J.M. Baldasano, 2013. Modeling and evaluation of the global sea-salt aerosol distribution: sensitivity to size-resolved and sea-surface temperature dependent emission schemes. ***Atmospheric Chemistry and Physics***, 13, 11735-11755. doi:10.5194/acp-13-11735-2013.
10. Menut, L., **C. Pérez**, K. Haustein, B. Bessagnet, C. Prigent and S. Alfaro, 2013. Impact of surface roughness and soil texture on mineral dust emission fluxes modeling. ***Journal of Geophysical Research****, 118,* 6505-6520. doi:10.1002/jgrd.50313

**Other important publications:**

11. **Pérez, C**., K. Haustein, Z. Janjic, O. Jorba, N. Huneeus, J.M. Baldasano, T. Black, S. Basart, S. Nickovic, R.L. Miller, J.P. Perlwitz, M. Schulz, and M. Thomson, 2011. Atmospheric dust modeling from meso to global scales with the online NMMB/BSC-Dust model — Part 1: Model description, annual simulations and evaluation. ***Atmospheric Chemistry and Physics****, 11*, 13001-13027. doi:10.5194/acp-11-13001-2011
12. Haustein, K., **C. Pérez**, J.M. Baldasano, O. Jorba, S. Basart, R.L. Miller, Z. Janjic, T. Black, S. Nickovic, M.C. Todd, and R. Washington, 2012. Atmospheric dust modeling from meso to global scales with the online NMMB/BSC-Dust model - Part 2: Experimental campaigns in Northern Africa. ***Atmospheric Chemistry and Physics,*** *12,* 2933-2958. doi:10.5194/acp-12-2933-2012.
13. **Pérez, C.,** Nickovic, S., Pejanovic, G., Baldasano, J.M., Özsoy, E., 2006. Interactive dust-radiation modeling: a step to improve weather forecast. ***Journal of Geophysical Research***, 111, D16206. doi:10.1029/2005JD006717.
14. **Pérez, C**., Nickovic, S., Baldasano, J.M., Sicard, M., Rocadenbosh, F., Cachorro, V.E., 2006. A long Saharan dust event over the western Mediterranean: Lidar, sun photometer observations and regional dust modeling. ***Journal of Geophysical Research***, 111, D15214. doi:10.1029/2005JD006579.
15. **Pérez, C.,** Sicard, M., Jorba, O., Comerón, A., and Baldasano, J.M, 2004. Summertime re-recirculations of air pollutants over the north-eastern Iberian coast observed from systematic EARLINET lidar measurements in Barcelona, ***Atmospheric Environment***, 38: 3983-4000.
16. Basart, S., M.T. Pay, O. Jorba, **C. Pérez**, P. Jiménez-Guerrero, M. Schulz, and J.M. Baldasano, 2012. Aerosols in the CALIOPE air quality modelling system: validation and analysis of PM levels, optical depths and chemical composition over Europe. ***Atmospheric Chemistry and Physics*****,** 12, 3363-3392. doi:10.5194/acp-12-3363-2012.
17. Schulz, M., J.M. Prospero, A.R. Baker, F. Dentener, L. Ickes, P.S. Liss, N.M. Mahowald, S. Nickovic**, C. Pérez**, S. Rodríguez, M. Manmohan Sarin, I. Tegen, and R.A. Duce, 2012. The atmospheric transport and deposition of mineral dust to the ocean: Implications for research needs. ***Environmental Science and Technology***, 46, 10390-10404. doi:10.1021/es300073u.
18. Jorba, O., D. Dabdub, C. Boxe, **C. Pérez**, Z. Janjic, and J.M. Baldasano, 2012. Potential significance of photoexcited NO2 on global air quality with the NMMB/BSC chemical transport model. ***Journal of Geophysical Research***, 117, D13301. doi:10.1029/2012JD017730.

19. Seifert, P., Ansmann, A., Mattis, I., Wandinger, U., Tesche, M., Engelmann, R., Müller, D., **Pérez, C**., and Haustein, K., 2010. Saharan dust and heterogeneous ice formation: Eleven years of cloud observations at a central–European EARLINET site. ***Journal of Geophysical Research*****,** 115, D20201. doi:10.1029/2009JD013222.

20. Basart, S., **Pérez, C**., Cuevas, E., Baldasano, J. M., and Gobbi, G. P., 2009. Aerosol characterization in Northern Africa, Northeastern Atlantic, Mediterranean Basin and Middle East from direct-sun AERONET observations, ***Atmospheric Chemistry and Physics*****,** 9, 8265-8282. www.atmos-chem-phys.net/9/8265/2009/. doi:10.5194/acp-9-8265-2009.

21. Haustein, K., **C. Pérez**, J.M Baldasano, D. Müller, M. Tesche, A. Schladitz, V. Freudenthaler, B. Heese, M. Esselborn, B. Weinzierl, K. Kandler, W.v Hoyningen-Huene, 2009. Regional dust model performance during SAMUM 2006. ***Geophysical Research Letters***, 36, L03812. doi:10.1029/2008GL036463.

22. Todd, M.C., D. Bou Karam, C. Cavazos, C. Bouet, B. Heinold, J.M. Baldasano, G. Cautenet, I. Koren, **C. Pérez**, F. Solmon, I. Tegen, P. Tulet, R. Washington, A. Zakey, 2008. Quantifying uncertainty in estimates of mineral dust flux: An intercomparison of model performance over the Bodélé Depression, northern Chad, ***Journal of Geophysical Research,*** 113, D24107. doi:10.1029/2008JD010476.

23. Papayannis, A., V. Amiridis, L. Mona, G. Tsaknakis, D. Balis, J. Bösenberg, A. Chaikovski, F. De Tomasi, I. Grigorov, I. Mattis, V. Mitev, D. Müller, S. Nickovic, **C. Pérez**, A. Pietruczuk, G. Pisani, F. Ravetta, V. Rizi, M. Sicard, T. Trickl, M. Wiegner, M. Gerding, R.E. Mamouri, G. D'Amico, G. Pappalardo, 2008. Systematic lidar observations of Saharan dust over Europe in the frame of EARLINET (2000-2002). ***Journal of Geophysical Research***, 113, D10204. doi:10.1029/2007JD009028**.**

24. Jiménez-Guerrero P., **C. Pérez**, O. Jorba and J.M. Baldasano, 2008. Contribution of Saharan Dust in an Integrated Air Quality System and its On-Line Assessment. ***Geophysical Research Letters***, 35, L03814. doi:10.1029/2007GL031580.

## INVITED TALKS

I am regularly invited as a speaker in international seminars, conference and workshops. I have given 26 invited talks. I list the 3 invited talks given in 2015:

- *Constraining the Dust Mineral Composition in Climate Models*. Conference on Airborne Dust, Climate Change, and Human Health. Organized by Henry F. Diaz, Joseph M. Prospero and Roger S. Pulwarty. Miami, May 19–21, 2015.
- *Can We Inform Reactive Vaccination Strategies for Meningococcal Meningitis in Sub-Saharan Africa Using Dust and Climate Predictors?* Conference on Human Health in the Face of Climate Change: Science, Medicine, and Adaptation. Organized by "la Caixa" Foundation, BIOCAT, the New York Academy of Sciences. Barcelona, May 14 - 15, 2015
- *Using Brittle Fragmentation Theory to Estimate Aerosol Mineral Composition in Climate Models*. Severo Ochoa Research Seminar Lectures. Barcelona Supercomputing Center. 26 March 2015.

## BOOK EDITOR

WMO/GEO Expert Meeting on an International Sand and Dust Storm Warning System. Editors: **C. Pérez** and J.M. Baldasano. IOP Conference Series: Earth Environmental Science, 2009. Vol. 7. doi: 10.1088/1755-1315/7/1/01 1001. [ISSN 1755-1307] http://iopscience.iop.org/1755-1315/7/1

## CHAPTERS IN BOOKS, PROCEEDINGS AND REPORTS

I have co-authored 28 chapters in books, proceeding and reports. I highlight 3 recent ones.

- Contributing author of the report *"The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment"* in the United States. The Report is part of the President's Climate Action Plan and ongoing efforts within the US Global Change Research Program (USGCRP), the Interagency Crosscutting Group on Climate Change and Human Health (CCHHG) and a subset of the Interagency National Climate Assessment Working Group (INCA). Draft is under public comment period.

- Benedetti, A., J.M. Baldasano, S. Basart, F. Benincasa, O. Boucher, M.E. Brooks, J.P. Chen, P.R. Colarco, S. Gong, N. Huneeus, L. Jones, S. Lu, L. Menut, J.J Morcrette, J. Mulcahy, S. Nickovic, **C. Pérez García-Pando**, J. S. Reid, T.T. Sekiyama, T.Y. Tanaka, E. Terradellas, D.L. Westphal, X.Y Zhang, and C.H Zhou, 2014. Operational Dust Prediction. In Mineral Dust — A Key Player in the Earth System. P. Knippertz, and J.-B.W. Stuut, Eds. Springer, 223-265, doi:10.1007/978-94-017-8978-3_10.
- Miller, R.L., P. Knippertz, **C. Pérez García-Pando**, J.P. Perlwitz, and I. Tegen, 2014. Impact of Dust Radiative Forcing Upon Climate. In P.Knippertz & JB Stuut (Ed.) Mineral Dust — A Key Player in the Earth System. Springer Publishing

## CONTRIBUTIONS TO INTERNATIONAL CONFERENCES AND WORKSHOPS

- I have co-authored about 130 contributions (short abstracts, presentations, posters) to international conferences, workshops and seminars (not listed).
- I will be co-convener of the session "*Role of dust and climate and role of dust for providing nutrients to marine and terrestrial ecosystems"* in the 2nd International Conference on Atmospheric Dust (DUST2016) in Italy.
- I organized the workshop: *"Dust, climate and Health in sub-Saharan Africa" s*ponsored by the Earth Institute. Location: Goddard Institute for Space Studies (New York) (28-29 May 2012).
- I was co-chair at the World Meteorological Organization SDS-WAS/GESAMP Expert Workshop on *"Modelling and Observing the Impacts of Dust Transport and Deposition on Marine Productivity"*, Malta. 7-9 March 2011.
- I was member of the Steering Committee and the local organizer of the *"WMO/GEO Expert Meeting on an International Sand and Dust Storm Warning System"* celebrated in Barcelona (Spain) (7-9/10/2007).
- Poster presentation prize at the 11th International Conference on Harmonisation within atmospheric dispersion modelling for atmospheric purposes. Work title: "Enhancing high-resolution air quality forecasting in MareNostrum supercomputer", P. Jiménez-Guerrero, O. Jorba, C. Pérez, S. Gassó y J.M. Baldasano (2007).

## MENTORING, EDUCATION, MEDIA and OUTREACH

- **Mentor:** Yang Liu. Graduate Research Assistant. M.A. in Climate and Society, Columbia University (2013); **Postdoc Advisor**: Dr Adrien Deroubaix. Co-advising with Paul Ginoux. (2015-2016); **PhD. Thesis Advisor and Sponsor:** Dr Sara Basart. UPC, Spain. PhD. Environmental Engineering (30/01/2012). Cum Laude, and Dr Karsten Haustein. UPC, Spain. PhD. Environmental Engineering (31/01/2012). Cum Laude; **Master Thesis Advisor:** Natalie Clave (Université Pierre et Marie Curie / BSC. Master in Remote Sensing Methods in Physics, 24/06/2006.) and Aurelien Henon (École Centrale de Nantes et l'Université de Nantes, Master in Mécaniques Appliquées / Specialité Dynamique des fluides et des transferts, 30/09/2005).
- **Principal Science Advisor** of the atmospheric dust module of the COMET program that provides education and training resources to benefit the operational forecaster community, university atmospheric scientists and students, and anyone interested in learning more about meteorology, weather forecasting, and related geoscience topics.
- **Media appearances and Outreach:**
    - The Guardian (http://www.theguardian.com/global-development/2014/mar/25/sahel-meningitis-outbreaks-wind-dust-levels)
    - Astrobiology Magazine (http://www.astrobio.net/exclusive/6065/climate-conditions-help-forecast-meningitis-outbreaks)
    - Trust.org (http://www.trust.org/item/20140320152117-zws64)
    - Climate Wire (behind paywall)
    - Phys.org (http://phys.org/news/2014-03-climate-conditions-meningitis-outbreaks.html)
    - SciDevNet (http://www.scidev.net/sub-saharan-africa/disease/news/dust-and-wind-linked-to-meningitis-belt-outbreaks.html.)
    - IRI (http://iri.columbia.edu/news/climate-conditions-help-forecast-meningitis-outbreaks) (http://vimeo.com/87435144)

- NASA GISS (http://www.giss.nasa.gov/research/features/201403_perez)
- NASA Global Climate Change (http://climate.nasa.gov/news/1054)
- Earth Institute (http://blogs.ei.Columbia.edu/2014/03/18/climate-conditions-help-forecast-meningitis-outbreaks)
- ECMWF (http://www.ecmwf.int/en/about/media-center/news/2014/macc-data-help-forecast-meningitis-outbreaks)
- PSHYCOLOGY TODAY (https://www.psychologytoday.com/blog/sensoria/201406/do-we-need-make-science-social)
- VOICE OF AMERICA (http://www.voanews.com/) (on the potential forecasting of infetious diseases, to appear soon)

**INSTITUTIONAL AGREEMENTS**

I have promoted and facilitated a number of "Memorandum of Understanding (MoU)" and collaborative agreements between Institutions:

- MoU between BSC and IRI for a regional dust model climatology for Northern Africa (2010);
- MoU between NCEP and BSC-CNS for the development of the NMMB/BSC-CHEM global/regional model (2009);
- Collaborative agreement between the National Weather service, the BSC-CNS and the National Research Council for the creation of the Regional Center of the Sand and Dust Storm Warning Advisory and Assessment System for North Africa, Middle East and Europe (2008);
- Collaborative agreement between the Council for Environment of the Canary Islands and the BSC-CNS to establish a high resolution Saharan dust forecast system in the Canary Islands (2008);
- Collaborative agreement between the BSC-CNS and the National Weather Service to implement, disseminate and evaluate a desert dust forecast system for the Iberian Peninsula and the Canary Islands (2006).
- (I have also contributed to the implementations of other MoU's and agreements)

**MODELS, TECHNOLOGY TRANSFER, CONSULTANCY**

- I have contributed to the development of several models and operational forecast systems:
  - BSC-DREAM8b model (Pérez et al., 2006a, Pérez et al., 2006b).
  - NMMB/BSC-Dust model (Pérez et al., 2011)
  - NNMB/BSC-CHEM (Spada et al., 2013, Jorba et al. 2013)
  - NASA Earth System ModelE (Miller et al., 2014):
  - Dust forecasts (http://sds-was.aemet.es, http://dust.aemet.es)
  - Air quality forecasts (http://www.bsc.es/caliope/es)
- The BSC-DREAM8b model has been distributed to a number of meteorological services and research groups in Europe, Africa and the Middle East.
- The NMMB/BSC-Dust and BSC-DREAM model forecast outputs are regularly used, among others, by:
  - ACMAD (the weather and climate organization with African continental authority) and National Meteorological and Hydrological Services in Africa and the Middle East to issue dust predictions and outlooks.
  - Research groups and networks such as EARLINET to plan lidar measurements in Europe.
  - The Spanish Ministry of Agriculture, Food and Environment to disentangle anthropogenic pollution episodes and dust episodes in Spain.
- My model developments and air quality expertise have contributed to technology transfer activities and consultancy services to private companies and public institutions (e.g. Gas Natural, Generalitat de Catalunya)

**OTHER HIGHLIGHTS**

- Member of the writing team of the Implementation Plan for an International Sand and Dust Storm Warning System of the World Meteorological Organization (WMO) (2007).
- Member of the Steering Committee of the WMO Sand and Dust Storm Warning System Regional Center for North Africa, Europe and Middle East. Member of the Regional Steering Group (2007-2010).
- Spanish scientific representative in the WHO led Meningitis Environmental Risk Information Technologies (MERIT) program (http://merit.hc-foundation.org/)
- Principal Investigator of the Barcelona Sun-Photometer AERONET station (Aerosol Robotic Network) of the NASA Goddard Space Flight Center. (2004 – 2009)
- I am reviewer of International SCI Journals in Atmospheric Sciences: 'Atmospheric Chemistry and Physics', 'Atmospheric Environment', 'Journal of Geophysical Research', 'Geophysical Research Letters', 'Tellus B', 'Theoretical and Applied Climatology', 'Geoscientific Model Development', 'Journal of Climate', 'Biomedcentral Infectious Diseases' and others.
- I have reviewed project proposals for the US Department of Energy (2014).

## 8.2 CV of other contributors to the Chair at the BSC-CNS

## Dr Francisco J. Doblas Reyes

Personal Address: Carrer dels Arbres 35, Badalona 08912, Spain

Professional Address: Barcelona Supercomputing Center

E-mail: francisco.doblas-reyes@bsc.es

Place and date of birth: Madrid, 7th June 1968

Nationality: Spanish

**1. Education**

- MSc degree in Physics at the Universidad Complutense of Madrid (Spain), June 1991.
- PhD in Physics with honors at the Universidad Complutense of Madrid (Spain). Thesis entitled "Atmospheric blocking: GCM simulation and associated precipitation patterns" (in Spanish). Date of dissertation: 22nd May 1996.
- Post-graduate courses at the University Complutense of Madrid from October 1992 to October 1996, and at Météo-France in September-October 1994.
- BSc degree in Mathematics at the Universidad Complutense of Madrid, June 1997.

**2. Professional Experience and Employment History**

- Since 2014, head of the Department of Earth Sciences of the Barcelona Supercomputing Center (BSC-CNS)
- Since December 2009, ICREA research professor at the Institut Català de Ciències del Clima (IC3, Barcelona, Spain), working as senior scientist and head of the Climate Forecasting Unit (http://ic3.cat/wikicfu), strong of more than 20 people (scientists, technicians and PhD students).
- From March 2000 to November 2009 at the European Centre for Medium-Range Weather Forecasts (ECMWF, Reading, UK), as research scientist.
- Visiting scientist at CINECA (Bologna, Italy) in March 2000.
- From February 1999 to February 2000 at the Centro de Astrobiología, Instituto Nacional de Técnicas Aeroespaciales (Madrid, Spain) as research assistant.
- Visiting scientist at the Institute of Atmospheric Physics (Academy of Sciences, Prague, Czech Republic) in July and August 1997.
- From January 1997 to January 1999 at the CNRM (Météo-France, Toulouse, France) as research assistant.
- Visiting scientist at the CNRM (Météo-France, Toulouse, France) in September-November 1994.
- Visiting scientist at the Instituto Meteorológico Nacional (Asunción, Paraguay) in August 1994.
- From October 1992 to September 1996 at the Departamento de Física de la Tierra, Astronomía y Astrofísica II (Universidad Complutense, Madrid, Spain) as PhD student.

**3. Membership on Committees and Panels**

- Working Group on Seasonal-to-Interannual Prediction (WGSIP) of the World Climate Research Programme (WCRP), member from 2011, co-chair since 2012 (http://www.wcrp-climate.org/index.php/wgsip-overview).
- Modelling Advisory Council (WMAC) of the WCRP, member since 2012 (http://www.wcrp-climate.org/WMAC.shtml).
- Polar Prediction Project (PPP) of the World Weather Research Programme (WWRP), member since 2011 (http://polarprediction.net).
- Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), lead author 2010-2013.
- Decadal Climate Prediction Panel (DCPP) of the WCRP, member since 2012 (http://www.wcrp-climate.org/decadal/cmip5.shtml).

- European Climate, Observations and Modelling for Services (ECOMS) panel of the European Commission, member since 2012 (http://www.eu-ecoms.eu/).
- European Network for Earth System Modelling (ENES) High-Performance Computing Task Force, member since 2012 (https://verc.enes.org/ISENES2/project/na1-wp2-enes-strategy).

**4. Selected Peer-Reviewed Publications (out of more than 100)**

1. Doblas-Reyes, F.J., I. Andreu-Burillo, Y. Chikamoto, J. García-Serrano, V. Guemas, M. Kimoto, T. Mochizuki, L.R.L. Rodrigues and G.J. van Oldenborgh (2013). Initialized near-term regional climate change prediction. *Nature Communications*, **4**, 1715, doi:10.1038/ncomms2704.
2. Guemas, V., F.J. Doblas-Reyes, I. Andreu-Burillo and M. Asif (2013). Retrospective prediction of the global warming slowdown in the past decade. *Nature Climate Change*, **3**, 649-653, doi:10.1038/nclimate1863.
3. Doblas-Reyes, F.J., J. García-Serrano, F. Lienert, A. Pintó Biescas and L. R. L. Rodrigues (2013). Seasonal climate predictability and forecasting: status and prospects. *WIREs Climate Change*, **4**, 245-268, doi:10.1002/WCC.217.
4. Kirtman, B., S. Power, J.A. Adedoyin, G.J. Boer, R. Bojariu, I. Camilloni, F.J. Doblas-Reyes, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schär, R. Sutton, G.J. van Oldenborgh, G. Vecchi and H.J. Wang (2013)*. Near-term climate change: Projections and predictability. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (Eds), 953-1028, Cambridge University Press.
5. Thomson, M.C., F.J. Doblas-Reyes, S.J. Mason, R. Hagedorn, S.J. Connor, T. Phindela, A.P. Morse and T.N. Palmer (2006). Malaria early warnings based on seasonal climate forecasts from multi-model ensembles. *Nature*, **439**, 576-579.

**5. Resources Obtained (over 3,590,000 euros since 2010)**

- RESILIENCE (Strengthening the European Energy Network using Climate Services), coordinator, Spanish Ministry of Economy and Competition (MINECO), 2015-2017, 270,000 euros.
- EUCLEIA, European Commission FP7, 2014-2016, contract 607085, 138,283 euros.
- PREFACE, European Commission FP7, 2014-2017, contract 603521, 266,569 euros.
- Multi-annual forecasts of Atlantic tropical cyclones in a climate service context, Risk Prediction Initiatives, 2013-2014, 54,493 US dollars.
- IS-ENES2 (InfraStructure for the European Network for Earth System Modelling), European Commission FP7, 2013-2017, 57,421 euros.
- EUPORIAS (EUropean Provision Of Regional Impact Assessment on a Seasonal-to-decadal timescale), European Commission FP7, 2012-2017, contract 308291, 355,723 euros.
- SPECS (Seasonal-to-decadal climate Prediction for the improvement of European Climate Services), coordinator, European Commission FP7, 2012-2017, contract 3038378, 1,615,305 euros.
- DENFREE (Dengue research Framework for Resisting Epidemics in Europe), European Commission FP7, 2012-2016, contract 282378, 100,000 euros.
- INCLIDA (Initialization of global decadal climate forecast: a new challenge for multi-scale data assimilation), European Commission-Marie Curie, 2012-2014, contract 275505, 166,565 euros.
- Predicción del riesgo de eventos de precipitación intensa en el Mediterráneo occidental y de la frecuencia de ciclones tropicales en el Atlántico a escala decadal, Fundación MAPFRE, 2011, 15,000 euros.
- RUCSS (Reducing Uncertainty in global Climate Simulations using a Seamless climate prediction system), coordinator, Spanish Ministry of Science and Innovation (MICINN), 2011-2013, 156,000 euros.
- CLIM-RUN (Climate Local Information in the Mediterranean region Responding to User Needs), European Commission FP7, 2011-2014, contract 265192, 214,479 euros.
- Metafor (Common Metadata for Climate Modelling Digital Repositories), subcontractor, European Commission FP7, 2010-2011, contract 211753, 50,000 euros.

- QWeCI (Quantifying Weather and Climate Impacts on Health in Developing Countries), European Commission FP7, 2010-2013, contract 243964, 147,231 euros.

**6. Awards and Recognitions**

- Recipient of the Mumm-Gerbier Prize in 2006 (http://www.wmo.int/pages/about/awards/winners_mumm_en.html).

## Dr Oriol Jorba Casellas

**Surnames:** Jorba Casellas
**Name:** Oriol
**NIE:** 46235919P
**Date of birth:** 09/07/1975
**Gender:** Hombre
**Phone number:** (+34) 934134050
**Email:** oriol.jorba@bsc.es

**Current professional situation**

**Employing entity:** Barcelona Supercomputing Center - Centro Nacional de Supercomputación
**Type of entity:** R&D Centre
**Professional category:** Group Manager of the Atmospheric Modelling group
**Start date:** 01/03/2008
**Type of contract:** Permanent employment
**Dedication regime:** Full time
**Primary (UNESCO code):** 250000 - Earth and space sciences
**Secondary (UNESCO code):** 250100 - Atmospheric sciences
**Tertiary (UNESCO code):** 250121 - Numerical modelling

**Previous positions and activities**

**Employing entity:** Barcelona Supercomputing Center - Centro Nacional de Supercomputación
**Type of entity:** R&D Centre
**Professional category:** Investigador Junior
**Start-End date:** 2005 - 2008 **Duration:** 4 years

**Employing entity:** Escuela Técnica Superior de Ingenieros Industriales de Terrassa
**Professional category:** Ayudante de docencia
**Start-End date:** 2004 - 2005 **Duration:** 1 year

**UNIVERSITY EDUCATION**

**University degree:** Higher degree
**Name of qualification:** Ingeniero Industrial Sección Técnicas Energéticas
**Degree awarding entity:** Escuela Técnica Superior de ingenieros Industriales de Barcelona
**Type of entity:** University
**Date of qualification:** 1999

**Doctorate programme:** Programa Oficial de Doctorado en Ingeniería Ambiental
**Degree awarding entity:** Universitat Politècnica de Catalunya
**Type of entity:** University
**Date of degree:** 2005

**TEACHING EXPERIENCE**
**General teaching experience**
**Name of the course:** Fundamentos de proyectos I
**University degree:** Ingeniero Industrial Especialidad Organización Industrial
**Start date:** 2004
**End date:** 2005
**Entity:** Escuela Técnica Superior de Ingenieros Industriales de Terrassa
**Type of entity:** University

**Experience supervising doctoral thesis and/or final year projects**
**1) Thesis title:** Implementation, development and evaluation of the gas-phase chemistry within the Global/Regional NMMB/BSC Chemical Transport Model (NMMB/BSC-CTM)
**Entity:** Universitat Politècnica de Catalunya **Type of entity:** University
**Student:** Alba Badia Moragas
**Date of reading:** 12/12/2014

**2) Thesis title:** Sistema de pronóstico de radiación solar a corto plazo a partir de un Modelo meteorológico y técnicas de post-proceso para españa
**Entity:** Universitat Politècnica de Catalunya **Type of entity:** University
**Student:** Angel Rincón Rodríguez
**Date of reading:** 28/06/2013

**3) Thesis title:** Variational multiscale stabilization of finite and spectral elements for dry and moist atmospheric problems
**Entity:** Universitat Politècnica de Catalunya **Type of entity:** University
**Student:** Simone Marras
**Date of reading:** 10/12/2012

**4) Project title:** Análisis de retrotrayectorias con llegada a países del Mediterráneo
**Type of project:** End of course project
**Co-director of thesis:** Jose Maria Baldasano Recio
**Entity:** Universitat Politècnica de Catalunya **Type of entity:** University
**City of entity:** Barcelona, Catalonia, Spain
**Student:** Beatriz Lorca
**Obtained qualification:** 7
**Date of reading:** 14/10/2006

**SCIENTIFIC AND TECHNOLOGICAL EXPERIENCE**
**Scientific or technological activities**
*Participated in **23** R&D projects funded through competitive calls of publico r private entities.*
*Participated in **16** R&D non-competitive contracts, agreements or projects with publico r private entities.*
*Principal Investigator in:*

**1) Name of the project:** Aerosol forecasting and assessment of radiative forcing on weather and climate applications with the online NMMB/BSC-CTM model
**Entity where project took place:** Barcelona Supercomputing Center
**Type of entity:** R&D Centre
**City of entity:** Barcelona, Catalonia, Spain
**Name principal investigator (PI, Co-PI....):** Oriol Jorba Casellas; Jose Baldasano Recio
**Nº of researchers:** 12
**Funding entity or bodies:** Ministerio de Economía y Competitividad **Type of entity:** Ministerio
**City funding entity:** Madrid, Community of Madrid, Spain
**Start-End date:** 2014 - 2016
**Total amount:** 170.610

**2) Name of the project:** Implementación de un mecanismo químico acoplado on-line dentro del modelo atmosferico UMO/DREAM
**Entity where project took place:** Barcelona Supercomputing Center

**Type of entity:** R&D Centre
**Name principal investigator (PI, Co-PI....):** Oriol Jorba Casellas
**Nº of researchers:** 5
**Funding entity or bodies:** Ministerio de Ciencia e Innovación **Type of entity:** Ministerio
**City funding entity:** Madrid, Community of Madrid, Spain
**Start-End date:** 2009 - 2011 **Duration:** 3 years
**Participating entity/entities:** BSC
**Total amount:** 127.292

**Scientific production**
52 publications in peer-reviwed international journals and more than 80 contributions in international conferences.
Highlighted publications:

**1)** W.R. Sessions; J.S. Reid; A. Benedetti; P.R. Colarco; A. Da Silva; S. Lu; T. Sekiyama; T.Y. Tanaka; J.M. Baldasano; S. Basart; M.E. Brooks; T.F. Eck; M. Iredell; J.A. Hansen; O. Jorba; H.-M.H. Juang; P. Lynch; J.-J. Morcrette; S. Moorthi; J. Mulcahy; Y. Pradhan; M. Razinger; C.B. Sampson; J. Wang; D.L. Westphal. Development towards a global operational aerosol consensus: Basic climatological characteristics of the International Cooperative for Aerosol Prediction Multi-Model Ensemble (ICAP-MME). **Atmospheric Chemistry and Physics**. 15 - 1, pp. 335 - 362. **2015**.
.
**2)** M. Spada; O. Jorba; C. Pérez García-Pando; Z. Janjic; J.M. Baldasano. On the evaluation of global sea-salt aerosol models at coastal/orographic sites. **Atmospheric Environment**. 101, pp. 41 - 48. **2015**.

**3)** M Pandolfi; X Querol; A Alastuey; JL Jimenez; O Jorba; D Day; A Ortega; MJ Cubison; A Comerón; M Sicard; others. Effects of sources and meteorology on particulate matter in the Western Mediterranean Basin: An overview of the DAURE campaign. **Journal of Geophysical Research**: Atmospheres. 119 - 8, pp. 4978 - 5010. **2014**.

**4)** A Badia; O Jorba. Gas-phase evaluation of the online NMMB/BSC-CTM model over Europe for 2010 in the framework of the AQMEII-Phase2 project. **Atmospheric Environment**. **2014**.

**5)** Alexander Baklanov; K Schlünzen; Peter Suppan; Jose Baldasano; Dominik Brunner; Sebnem Aksoyoglu; Greg Carmichael; John Douros; Johannes Flemming; Renate Forkel; others. Online coupled regional meteorology chemistry models in Europe: current status and prospects. **Atmospheric Chemistry and Physics**. 14 - 1, pp. 317 - 398. **2014**.

**6)** M Spada; O Jorba; C Pérez García-Pando; Z Janjic; JM Baldasano. Modeling and evaluation of the global sea-salt aerosol distribution: sensitivity to size-resolved and sea-surface temperature dependent emission schemes. **Atmospheric Chemistry and Physics**. 13 - 23, pp. 11735 - 11755. **2013**.

**7)** O Jorba; M Pandolfi; M Spada; JM Baldasano; J Pey; A Alastuey; D Arnold; M Sicard; B Artiñano; MA Revuelta; others. Overview of the meteorology and transport patterns during the DAURE field campaign and their impact to PM observations. **Atmospheric Environment**. 77, pp. 607–620. **2013**.

**8)** Jorba; O.; D. Dabdub; C. Blaszczak-Boxe; C. Pérez; Z. Janjic; J. Baldasano; M. Spada; A. Badia; and M. Gonçalves. Potential significance of photoexcited NO2 on global air quality with the NMMB/BSC chemical transport model. **Journal of Geophysical Research**. 117, pp. 1 - 16. **2012**.

**9)** Pay; M.T.; Piot; M.; Jorba; O.; Gassó; S.; Gonçalves; M.; Basart; S.; Dabdub; D.; Jiménez-Guerrero; P.; Baldasano; J.M.A full year evaluation of the CALIOPE-EU air quality modeling system over Europe for 2004. **Atmospheric Environment**. 44, pp. 3322 - 3342. **2010**.

**10)** Jorba O.; C. Pérez; F. Rocadenbosch; and J. M. Baldasano. Cluster Analysis of 4-Day Back Trajectories Arriving in the Barcelona Area (Spain) from 1997 to 2002. **Journal of Applied Meteorology**. 43, pp. 887 - 901. **2004**.

**Stays in public or private R&D centres**

**1) Entity:** NASA Goddard Institute for Space Studies **Type of entity:** R&D Centre
**City of entity:** New York, United States of America
**Start-End date:** 04/03/2013 - 12/06/2013 **Duration:** 3 months - 12 days

**2) Entity:** University of California, Irvine **Type of entity:** University
**City of entity:** Irvine, United States of America
**Start date:** 02/05/2011 **Duration:** 4 months

**National and international forums and committees**

**1) Name of the forum:** COST ACTION ES1004 - European framework for online integrated air quality and meteorology modelling (EuMetChem)
**Professional category:** Member of the Management Committee
**Organising entity:** Unión Europea
**Start-End date:** 20/01/2011 - 2014

**2) Name of the forum:** COST ACTION ES1002 - Weather Intelligence for Renewable Energies (WIRE)
**Professional category:** Member of the Management Committee
**Organising entity:** Union Europea **Type of entity:** State agency
**Start-End date:** 05/08/2010 - 2013

**Evaluation and revision of R&D projects and articles**

**1) Name of the activity:** External review
**Performed tasks:** Reviewer I+D+i Spanish National Projects
**Entity where activity was carried out:** Agencia Nacional de Evaluación y Prospectiva
**Type of entity:** Ministerio
**City of entity:** Madrid, Community of Madrid, Spain
**Start-End date:** 2011 – 2014

**2) Name of the activity:** Scientific Jorunal Reviewer
**Performed tasks:** Reviewer peer-review international journals
**Type of activity:** Review of articles in scientific or technological journals
**Frequency of the activity:** 9
**Access system:** Designated by the corresponding party without competition
**Geographical area:** Non EU International

**Organization of R&D activities**

**1) Title of the activity:** IS-ENES 1st General Assembly
**Type of activity:** General Assembly **Geographical area:** European Union
**Convening entity:** CNRS-IPSL **Type of entity:** R&D Centre
**City convening entity:** Barcelona, Catalonia, Spain
**Start-End date:** 2010 - 2010 **Duration:** 3 days

**2) Title of the activity:** International Technical Meeting on Air Pollution Modeling and its Applications
**Type of activity:** Conference – Member of the Steering Committee
**Geographical area:** Non EU International
**Start date:** 2015

**3) Title of the activity:** International Technical Meeting on Air Pollution Modeling and its Applications
**Type of activity:** Conference – Member of the Steering Committee
Steering Commitee
**Geographical area:** Non EU International
**Start date:** 2013

**4) Title of the activity:** NATO/SPS International Technical Meeting on Air Pollution Modelling and its Application

**Type of activity:** Conference – Member of the Steering Committee
Commmittee
**Geographical area:** Non EU International
**Convening entity:** NATO
**Start date:** 07/05/2012

## Dr Virginie Guemas

**Mail :** Institut Català de Ciències del Clima, Carrer del Doctor Trueta, 203
08005 Barcelona, Spain,
**E-mail :** virginie.guemas@ic3.cat

### RESEARCH INTERESTS

- Predictability of the Arctic sea ice cover and its impact in the Northern Hemisphere
- XXIst century global temperature plateau
- Interannual variability of the Atlantic thermohaline circulation
- North Pacific Ocean predictability

### PROJECT LEADERSHIP

- **PI** of the **PICA-ICE** project (Previsión Interanual de la Cubierta de hielo marino del Árctico y su Impacto en el Clima de Europa) funded by the Spanish Ministry of Economy and Competition which started in January 2013 and last for 3 years. The allocated budget amounts to **€149.760** and the reference number is **CGL2012-31987**.

### SUPERVISION

- Danila Volpi, PhD Student, January 2011 - June 2014: *Impact of the initialization in global dynamical decadal climate forecasts*. Co-supervision.
- Neven Fuckar, post-doctoral scientist, May 2013 - present: *Arctic sea ice cover prediction on seasonal to decadal timescales*.

### PRIZES AND AWARDS

- 2010 Adrien Gaussail PhD prize: This prize is awarded every 2 years to a scientific PhD Thesis by the Académie des Sciences Inscriptions et Belles Lettres (http://academie.laurans.org/Prix_attribues_en_2010.html)
- 2012 Young Scientist Travel Award: This prize is awarded by the European Meteorological Society to support participation of outstanding students and young scientists at EMS-co-sponsored conferences (http://www.emetsoc.org/awards/travel-awards-ystas)
- 2005 Excellence scholarship for Master students: This €4000 scholarship is awarded by the Université Paul Sabatier to their best students in exchange for a commitment to do a PhD.

**INVITED STAYS**

- ECMWF (European Center for Medium Range Weather Forecasts, Reading, England)- WWRP/THORPEX workshop on Polar Prediction and Year of Polar Prediction Planning Meeting in June 2012: invitation by the Word Meteorological Organization
- ECMWF in January 2012: invitation for a 3-day stay at the by Susanna Corti, Magdalena Balmaseda and Kristian Morgensen.
- MPI (Max Planck Institute for Meteorology, Hamburg, Germany) in December 2011: invitation by Daniela Matei, Wolfgang Mueller and Holger Pohlmann for a one-week stay
- NCAS (National Center for Atmospheric Sciences, Reading, England).in December 2008: invitation by Rowan Sutton for a one-week stay

**PEER REVIEWED PUBLICATIONS**

**1. Guemas V.,** Doblas-Reyes F., Andreu-Burillo I., Asif M., 2013, Retrospective prediction of the global warming slowdown in the last decade, **Nature Climate Change**, DOI:10.1038/nclimate1863.

**2.** Doblas-Reyes F., Andreu-Burillo I., Chikamoto Y., García-Serrano J., **Guemas V.,** Kimono M., Mochizuki T., Rodrigues L. R. L., van Oldenborgh G. J., 2013, Initialized near-term regional climate change prediction, **Nature Communications**, 4, 1715, DOI:1038/ncomms2704.

**3. Guemas V**., Doblas-Reyes F., Germe A., Chevallier M., Salas y Mélia D., 2013, September 2012 Arctic sea ice minimum: Discriminating between sea ice memory, the August 2012 extreme storm and prevailing warm conditions [in "Explaining Extreme Events of 2012 from a Climate Perspective"], Bull. Amer. Meteor. Soc., 94 (9), S20-S22.

**4.** Wouters B., Hazeleger W., Drijfhout S., van Oldenborgh G., **Guemas V**., 2013, Multiyear predictability of the North Atlantic subpolare gyre. Geophysical Research Letters, doi:10.1002/grl.50585.

**5.** Volpi, D., Doblas-Reyes F. J., García-Serrano J., **Guemas V**., 2013, Dependence of the climate prediction skill on spatio-temporal scales : internal versus radiatively-forced contribution. Geophysical Research Letters, doi:10.1002/grl.50557.

**6.** Hazeleger, W., **V. Guemas**, B. Wouters, S. Corti, I. Andreu-Burillo, F.J. Doblas-Reyes, K. Wyser and M. Caian (2013). Multiyear climate predictions using two initialisation strategies. Geophysical Research Letters, DOI:10.1002/grl.50355.

**7. Guemas, V**., Salas-Melia D., Kageyama M., Giordani H., Voldoire A., 2013, Impact of the ocean diurnal cycle on the North Atlantic European mean climate in a regionally coupled model, Dynamics of Atmospheres and Oceans, 60, 28-45, DOI:10.1016/j.dynatmoce.2013.01.001.

**8. Guemas V**., Corti S., Garcìa-Serrano J., Doblas-Reyes F., Balmaseda M., Magnusson L., 2013, The Indian Ocean: the region of highest skill worldwide in decadal climate prediction, Journal of Climate, 26(3), 726-739 DOI:10.1175/JCLI-D-12-00049.1.

**9.** Smith D. M., Scaife A. A., Boer G. J., Caian M., Doblas-Reyes F. J., **Guemas V.,** Hawkins E., Hazeleger W., Hermanson L., Ho C. K., Ishii M., Kharin V., Kimoto M., Kirtman B., Lean J., Matei D., Merryfield W. J., Müller W. A., Pohlmann H., Rosati A., Wouters B., Wyser K., 2012, Real-time multi-model decadal climate predictions, Climate Dynamics, DOI:10.1007/s00382-012-1600-0.

**10. Guemas, V.**, Doblas-Reyes F., Lienert F., Du H., Soufflet Y., 2012, Identifying the causes for the low decadal climate forecast skill over the North Pacific, Journal of Geophysical Research, 117, D20111, DOI:10.1029/2012JD018004.

**11.** Hourdin F., Foujols M.A., Codron F., **Guemas V.**, Dufresne J.L., Bony S., Denvil S., Guez L., Lott F., Gatas J., Braconnot P., Marti O., Meurdesoif Y. Bopp, L., 2012, Impact of the LMDZ atmospheric grid configuration on the climate and sensitivity of the IPSL-CM5A coupled model, Climate Dynamics, 40, 2167-2192, DOI: 10.1007/s00382-012-1411-3

**12.** Du, H., Doblas-Reyes, F, Garcia-Serrano, J., **Guemas, V**., Soufflet, Y., Wouters, B., 2012, Impact of initial perturbations in decadal predictions. *Climate Dynamics*, 39, 2013-2023, DOI: 10.1007/s00382-011-1285-9.

**13. Guemas, V.**, Codron F., 2011, Differing impacts of resolution changes in latitude and longitude on the mid-latitudes in the LMDZ GCM. *Journal of Climate*, 24 (22), 5831-5849, DOI: 10.1175/2011JCLI4093.1.

**14. Guemas, V.**, Salas-Mélia D., Kageyama M., Giordani H., Voldoire A., 2011, Impact of the ocean mixed layer diurnal variations on the intraseasonal variability of Sea Surface Temperatures in the Atlantic Ocean. *Journal of Climate,* 24 (12), 2889-2914, DOI: 10.1175/2010JCLI3660.1.

**15.** Menégoz, M., **Guemas, V.**, Salas-Mélia D., Voldoire A., 2010, Winter interactions between aerosols and weather regimes in the North-Atlantic European region. *Journal of Geophysical Research,* 115, D09201, DOI: 10.1029/2009JD012480.

**16, Guemas, V.**, Salas-Mélia D., Kageyama M., Giordani H., Voldoire A., Sanchez-Gomez E., 2010, Summer interactions between weather regimes and surface ocean in the North-Atlantic region. *Climate Dynamics*, 34, 527-546, DOI: 10.1007/s00382-008-0491-6.

**17. Guemas, V.**, Salas-Mélia D., Kageyama M., Giordani H., Voldoire A., Sanchez-Gomez E., 2009, Winter interactions between weather regimes and marine surface ocean in the North-Atlantic European region. *Geophysical Research Letters*, 36, L09816, DOI: 10.1029/ 2009GL037551.

**18. Guemas, V.**, Salas-Mélia, D., 2008, Simulation of the Atlantic Meridional Overturning Circulation in an Atmosphere-Ocean Global Coupled Model. Part II: A weakening in a climate change experiment: a feedback mechanism. *Climate Dynamics*, 30, 831-844, DOI: 10.1007/s00382-007-0328-8.

**19. Guemas, V.**, Salas-Mélia, D., 2008, Simulation of the Atlantic Meridional Overturning Circulation in an Atmosphere-Ocean Global Coupled Model. Part I: A mechanism governing the variability of ocean convection in a preindustrial experiment. *Climate Dynamics*, 31, 29-48, DOI: 10.1007/s00382-007-0336-8.

*In Progress:*

**20. Guemas, V.**, Auger L, Doblas-Reyes F.J. 2013, Hypothesis testing for auto-correlated short climate time series, revised for Journal of Applied Meteorology and Climatology. JAMC-D-13-064

**21.** Carrassi A., Weber R, **Guemas, V.**, Doblas-Reyes F.J., Asif M., Volpi D, 2013, Full-field and anomaly initialization using a low-order climate model: a comparison and proposals for advanced formulations, in revision for Non Linear Processes in Geophysics. npg-2013-75.

**22. Guemas V.,** Doblas-Reyes F J, Mogensen K, Tang Y. Keeley S, 2013 Ensemble of sea ice initial conditions for interannual climate predictions, in revision for Climate Dynamics. CLIDY-D-13-00282.

**23. Guemas V.,** Garcia-Serrano J, Mariotti A., Doblas-Reyes F.J, Caron LP, 2013 Prospects for decadal climate prediction in the Mediterranean region, in revision for Quarterly Journal of the Royal Meteorological Society. QJ-13-0165.

**24. Guemas V**, Blanchard-Wrigglesworth E, Chevallier M, Déqué M, Doblas-Reyes F J, Fucker N, Germe A, Hawkins E, Keeley S, Koenigk T, Salas y Melia D, Tietsche S, 2013, A review on Arctic sea ice predictability and predictions on seasonal to decadal timescales. Invited contribution to be submitted to Quarterly Journal of the Royal Meteorological Society as part of the Special Issue from the Polar Prediction Project (WMO/WWRP).

**25.** Garcia-Serrano J, **Guemas V**, Doblas-Reyes F J, 2013, Added-value from initialization in predictions of the Atlantic multi-decadal variability. To be submitted to Geophysical Research Letters.

**26.** Fuckar N, **Guemas V**, Volpi D, Doblas-Reyes F, A posteriori adjustment of near-term climate predictions, is soon to be submitted to Geophysical Research Letters.

**27.** Tietsche S., Day J, **Guemas V,** Hurlin W J, Keeley S, Matei D, Msadek R, Hawkins E, 2013, Seasonal to interannual Arctic sea-ice predictability in current GCMs, to be submitted.

## TEACHING EXPERIENCE

- 2006-2009: **Mechanics and Thermodynamics lessons** to BSc 1st year, ENM (Ecole Nationale de la Météorologie, Météo-France)
- 2007-2009: **Statistics lessons** to BSc 1st year, ENM (Ecole Nationale de la Météorologie, Météo-France)

## IPCC

WGI contributing author to the IPCC Fifth Assessment Report (AR5), Chapter 11 "Near-term climate change: projections and predictability"

## RESEARCH EXPERIENCE

- 2009-2010: Post-doctoral researcher, Laboratoire de Météorologie Dynamique/Institut Pierre Simon Laplace/CNRS/Université Pierre et Marie Curie

  **Project title: "Impact of the horizontal resolution in the LMDZ4 atmospheric model on the mid-latitude winter jet position"**

- 2006-2009: PhD, CNRM-Météo-France/LSCE

  **Title: "Role of the marine surface on the summer intraseasonal atmospheric circulation variability in the North Atlantic European region"**

- 2006, February-June: Master, CNRM-Météo-France/LSCE

  **Title: "Variability of the Atlantic meridional overturning circulation in the global coupled model CNRM-CM3"**

- 2005, August-September: Grant Institute, School of Geosciences, Edinburgh, Scotland

  **Title: "Paleoclimate - Interpretation of $\delta^{18}O$ data obtained from corals and foraminifers"**

- 2005, May-June: Laboratoire d'Aérologie, Toulouse, France

  **Title: "Internal waves - Modelling an academic case"**

- 2004, September: Laboratoire d'Aérologie, Toulouse, France

  **Title: "Electric activity of storms in Midi-Pyrenees (France)"**

**OTHER RELEVANT INFORMATION**

**Languages :** English, Spanish: fluent
Catalan: good knowledge
German: basic knowledge

**Other diploma:** first aid training certification, diploma for youth leaders, driving license

**Sport :** 10 years of gymnastics (1991-2001), France championship final (2000)

**Voluntary working:** Gymnastic trainer (1999-2001) with "Le Ralliement de Muret"
Support for elderly people (2004-2005) with "Petits Freres des Pauvres"

## Dr Sara Basart

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Nationality: Spanish
E-mail: sara.basart@bsc.es
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Research Gate: https://www.researchgate.net/profile/Sara_Basart

### Academic

2012

**Ph.D. in Engineering Environmental (Degree of European Doctor)**, Technical University of Catalonia (UPC)

- Dissertation title: "Desert dust characterization in Northern Africa, Middle East and Europe through regional dust modelling, and satellite-borne and ground-based observations".
- Directors: Dr Carlos Pérez and Dr Emilio Cuevas
- Visiting Ph.D. Student: Laboratoire des Sciences du Climat et de l'Environnement (LSCE/IPSL), Giff-sur-Yvette, France (2009, 4 months). Supervisor Dr Michael Schulz.

2008

**M.Sc. in Meteorology,** Barcelona University, Barcelona, Spain

2005

**Postgraduate in Meteorology and Climatology,** Barcelona University, Barcelona, Spain

**University-Degree in Physics,** Barcelona University, Barcelona, Spain

## Professional experience

2012 - now

**Postdoctoral researcher** *Earth Sciences Department, Barcelona Supercomputing Center (BSC), Barcelona, Spain*

- Participation in the implementation of primary aerosols in the NMMB/BSC-CTM multiscale model, with the aim to improve the understanding of the physico-chemical interaction processes that directly impacts on weather, air quality and climate through numerical modelling techniques.
- November 2012: Invited as a scientist expert in the training course on Atmospheric Sand and Dust, Barcelona. It was jointly organised by AEMET, BSC, EUMETSAT and WMO.

2008 - 2012

**Graduate Research Assistant** *Earth Sciences Department, Barcelona Supercomputing Center (BSC), Barcelona, Spain*

- Studies related to air quality levels over Europe (focusing on desert dust contributions) using CALIOPE air quality modelling system (www.bsc.es/caliope).
- June 2010: Scientist expert. Technical assistance for the Dust Transport Modelling, Turkish State Meteorological Service, Ankara. Technical Assistance and Information Exchange instrument (TAIEX) project managed by the European Commission for the dust transport modelling.

2005 - 2007

**Graduate Research Assistant** *Izana Atmospheric Research Center-Meteorological State Agency of Spain (CIAI-AEMET), Santa Cruz de Tenerife, Spain*

- Maintenance and operation of atmospheric aerosol instruments (sunphotometer, lidar, and high-volume ambient air sampler) from different international networks (i.e. GAW, AERONET or MPLNET)

2002-2005

**Technical position,** *Air quality Technician, Regional Catalan Government, Barcelona, Spain*

Maintenance of the air quality network, verification of the air quality data; and responsible for distribution of air quality information.

## International projects and collaborations

The Spanish Ministry of the Environment and Rural and Marine Affairs (Ministerio de Medio Ambiente y. Medio Rural y Marino) project called: “MEJORA DEL MODELO REGIONAL ATMOSFERICO DE POLVO MINERAL (DREAM) PARA LA PREDICCION DE EVENTOS DE POLVO SAHARIANO EN EL MEDITERRANEO Y LAS ISLAS CANARIAS” with reference CGL2006-11879.

The Spanish Ministry of Education and Science (Ministerio de Educación y Ciencia) project called: CALIOPE with reference 157/PC08/3-12.0.

The World Meteorological Organization (WMO; www.wmo.int) initiative called “Dust Storm Warning Advisory and Assessment System” (SDS-WAS; http://sds-was.aemet.es/) for Northern Africa-Middle East-European Regional Center.

The Spanish Ministry of Economy and Competitivity (Ministerio de Economia y Competitividad) project called: "ACOPLAMIENTO ONLINE DE UN MODULO COMPLETO DE AEROSOLES MULTICOMPONENTE AL MODELO ATMOSFERICO GLOBAL REGIONAL NMMB” with reference CGL2010-19652.

The Institute of Marine Science of the Spanish National Research council (CSIC) project called: “Aerosol deposition and ocean plankton dynamics (ADEPT)”.

The “Monitoring Atmospheric Composition & Climate (MACC, MACC-II, MACC-III)” FP7 European Project.

The International Cooperative on Aerosol Prediction (ICAP; http://www.nrlmry.navy.mil/aerosol/icap.1087.php)

The Spanish Ministry of the Environment and Rural and Marine Affairs (Ministerio de Medio Ambiente y. Medio Rural y Marino) project called: Chemistry-Aerosol Mediterranean Experiment (ChArMEx-España 2; CGL2011-13580-E/CLI).

The Spanish Ministry of Economy and Competitivity (Ministerio de Economia y Competitividad) project called: AMISOC (Atmospheric MInor Species relevant to the Ozone Chemistry at both sides of the jet) manage by INTA (Instituto Nacional de Técnica Aeroespacial).

Management of Barcelona AERONET site (http://aeronet.gsfc.nasa.gov/).

Diapason project (http://www.diapason-life.eu/) from Institute for Atmospheric Science and Climate of the National Research Council of Italy (CNR–ISAC; LIFE+ 2010 ENV/IT/391).

CV-Project, Universidad de Aveiro. This work was funded by the Portuguese Science Foundation (FCT) through the project FCOMP-01-0124-FEDER-008646 (CV-Dust).

The Spanish Ministry of the Environment and Rural and Marine Affairs (Ministerio de Medio Ambiente y. Medio Rural y Marino) project called: Aerosol forecasting and assessment of radiative forcing on weather and climate applications with the online NMMB/BSC-CTM model (CICYT CGL2013-46736-R)

Marie Curie Project "Effects of Mediterranean desert dust outbreaks on radiation, atmospheric dynamics and forecasting accuracy of a numerical mesoscale model"

Characterization of Aerosol mixtures of Dust And Marine origin (CHARADMexp) campaign is funded by the European Space Agency.

Aerosols, Clouds, and Trace gases Research InfraStructure Network (ACTRIS) is FP7 European Project.

## Participation in contracts

Consolider SysEC. Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC-CNS) y Ministerio de Ciencia e Innovación (MICINN). From 01/07/2011 to 31/01/2012. PI: Dr Mateo Valero.

Consolider SysEC. Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC-CNS) y Ministerio de Ciencia e Innovación (MICINN). From 01/02/2012 to 31/01/2012. PI: Dr Mateo Valero

## Postdoctoral visits

2015 (1 month)

**Postdoctoral Researcher** *NASA-GISS, New York City, USA*

- Collaboration project focusing on the deployment of the Aerosol Mineral Fraction (AMF) method (see Perlwitz et al., 2015a,b) in the NMMMB/BSC-CTM model to characterize the mineralogical composition of the dust aerosol and to assess the radiative forcing of dust-radiation interaction with NMMB/BSC-CTM. Supervisor: Carlos Pérez García-Pando.

2013 (5 months)

**Postdoctoral Researcher** *Laboratoire a Météorologie Dynamique (LMD), Paris, France*

- Collaboration project focusing on identify, characterize and classify the different synoptic meteorological conditions responsible for the desert dust intrusions over Europe using the observations of ground-based networks and on the other hand, the ability of models to simulate this episodes. Supervisors: Dr Olivier Boucher and Dr Nicolás Huneeus.

## Publications

### International Jounals Included in the Science Citation Index (SCI)

1. Amiridis, V., Kafatos, M., Pérez, C., Kazadzis, S., Gerasopoulos, E., Mamouri, R. E., Papayannis, A., Kokkalis, P., Giannakaki, E., **Basart, S.**, Daglis, I., and Zerefos, C.: The potential of the synergistic use of passive and active remote sensing measurements for the validation of a regional dust model, Ann. Geophys., 27, 3155-3164, doi:10.5194/angeo-27-3155-2009, 2009.
2. **Basart, S.**, Pérez, C., Cuevas, E., Baldasano, J. M., Gobbi, G. P.: Mineral dust characterization for North of Africa, Northeastern Atlantic, Mediterranean Basin and Middle East from direct-sun AERONET
3. Papanastasiou, D. K., Poupkou, A., Katragkou, E., Amiridis, V., Melas, D., Mihalopoulos, N., **Basart, S.**, Pérez, C. and Baldasano, J. M.: S. An Assessment of the Efficiency of Dust Regional Modelling to Predict Saharan Dust Transport Episodes, Advances in Meteorology, 2010(154368), doi:10.1155/2010/154368, 2010.
4. Pay, M. T., Piot, M., Jorba, O., Gassó, S., Gonçalves, M., **Basart, S.**, Dabdub, D., Jiménez-Guerrero, P., and Baldasano, J. M.: A Full Year Evaluation of the CALIOPE-EU Air Quality Modeling System over Europe for 2004, Atmos. Environ., 44, 3322-3342, doi:10.1016/j.atmosenv.2010.05.040, 2010.

5. Borrego, C., Monteiro, A., Pay, M. T., Ribeiro, I., Miranda, A.I., **Basart, S.**, and Baldasano, J. M.: How bias-correction can improve air quality forecast over Portugal, Atmos. Environ., 45, 6629-664, doi: 10.1016/j.atmosenv.2011.09.006, 2011.
6. Guirado, C., Cuevas, E., Cachorro, V., Mimouni, M., Zeudmi, L., Toledano, C., Alonso-Pérez, **S., Basart**, S., Blarel, L., Goloub, P., and Baldasano, J.M.: Preliminary characterization of columnar aerosol properties (AOD-AE) at the Saharan Tamanrasset (Algeria) station, Opt. Pura Apl., 44(4), 635-639, 2011.
7. Pérez, C., Haustein, K., Janjic, Z., Jorba, O., Huneeus, N., Baldasano, J.M., Black, T., **Basart, S.**, Nickovic, S., Miller, R.L., Perlwitz, J., Schulz, M. and Thomson, M.: Atmospheric dust modeling from meso to global scales with the online NMMB/BSC-Dust model – Part 1: Model description, annual simulations and evaluation, Atmos. Chem. Phys., 11, 13001-13027, doi:10.5194/acpd-11-13001-2011, 2011.
8. **Basart, S.**, Pay, M.T., Jorba, O., Pérez, C., Jiménez-Guerrero, P., Schulz, M. and Baldasano, J. M.: Aerosols in the CALIOPE air quality modelling system: validation and analysis of PM levels, optical depths and chemical composition over Europe, Atmos. Chem. Phys., 12, 3363-3392, doi:10.5194/acp-12-3363-2012, 2012.
9. **Basart, S.**, Pérez, C., Nickovic, S., Cuevas, E. and Baldasano, J. M.: Development and evaluation of BSC-DREAM8b dust regional model over Northern Africa, the Mediterranean and the Middle East regions, Tellus B, 64, 18539, doi: http://dx.doi.org/10.3402/tellusb.v64i0.18539, 2012.
10. Folch, A., Costa; A., and **Basart, S.**: Validation of the FALL3D ash dispersion model using observations of the 2010 Eyjafjallajökull volcanic ash clouds, Atmos. Environ., 48, 165-183, doi: http://dx.doi.org/10.1016/j.atmosenv.2011.06.072, 2012.
11. Haustein, K., Pérez, C., Baldasano, J.M., Jorba, O., **Basart, S.**, Miller, R.L., Janjic, Z., Black, T., Nickovic, S., Todd, M. and Washington, R.: Atmospheric dust modeling from meso to global scales with the online NMMB/BSC-Dust model: 2. Regional experiments in North Africa, Atmos. Chem. Phys., 12, 933–2958, doi:10.5194/acp-12-2933-2012, 2012.
12. Kokkalis, P., Mamouri, R.E., Todua, M., Didebulidze, G.G., Papayannis, A., Amiridis, V., **Basart, S.**, Pérez, C., and Baldasano, J.M.: Ground, satellite and simulation-based analysis of a strong dust event over Abastumani, Georgia during May 2009, International Journal of Remote Sensing, 33 (16), 4886-4901, doi:10.1080/01431161.2011.644593, 2012.
13. Pay, M.T., Jiménez-Guerrero, P., Jorba, O., **Basart, S.**, Querol, X., Pandolfi, M., and Baldasano, J.M.: Spatio-temporal variability of concentrations and speciation of particulate matter across Spain in the CALIOPE modeling system. Atmos. Environ., 46, 376-396, doi:10.1016/j.atmosenv.2011.09.049, 2012.
14. Amiridis, V., U. Wandinger, E. Marinou, E. Giannakaki, A. Tsekeri, **S. Basart**, S. Kazadzis, A. Gkikas, M. Taylor, J. Baldasano, and A. Ansmann "Optimizing Saharan dust CALIPSO retrievals", Atmos. Chem. Phys., 13, 12089-12106, doi:10.5194/acp-13-12089-2013, 2013.
15. Gobbi, G. P., Angelini, F., Barnaba, F., **Basart, S.**, Cattani, G., Inglessis, M., Marconi, A. and Baldasano, J.M.: Particulate Matter Increase during Saharan Advections in the City of Rome (Italy): A Four-Year Study (2001-2004), Atmos. Chem. Phys., acp-2012-1044, 2013.
16. Tchepel, O., Ferreira, J., Fernandes, A.P., **Basart, S**., Baldasano, J.M. and Borrego, C.: Analysis of long-range transport of aerosols for Portugal using 3D Chemical Transport Model and satellite measurements, Atmos. Environ., 64, 229-241, doi: 10.1016/j.atmosenv.2012.09.061, 2013.
17. Tsekeri, A., Amiridis, V., Kokkalis, P., Basart, S., Chaikovsky, A., Dubovik, O., Mamouri, R.E., Papayannis, A. and Baldasano, J.M.: Application of a synergetic lidar and sunphotometer algorithm for the characterization of a dust event over Athens, Greece, British Journal of Environment and Climate, 3(4), 531-546, doi: 10.9734/BJECC/2013/2615, 2013.
18. Gallisai, R., Peters, F., Volpe, G., **Basart, S.**, Baldasano, J.M.: Saharan dust deposition may affect phytoplankton growth in the Mediterranean Sea at ecological time scales, PloS one, 9(10), e110762, 2014.
19. Guirado, C., Cuevas, E., Cachorro, V. E., Toledano, C., Alonso-Pérez, S., Bustos, J. J., **Basart, S.**, Romero, P. M., Camino, C., Mimouni, M., Zeudmi, L., Goloub, P., Baldasano, J. M., and de Frutos, A. M.: Aerosol characterization at the Saharan AERONET site Tamanrasset, Atmos. Chem. Phys., 14, 11753-11773, doi:10.5194/acp-14-11753-2014, 2014.
20. Mona, L., Papagiannopoulos, N., **Basart, S.**, Baldasano, J., Binietoglou, I., Cornacchia, C., and Pappalardo, G.: EARLINET dust observations vs. BSC-DREAM8b modeled profiles: 12-year-long

systematic comparison at Potenza, Italy, Atmos. Chem. Phys., 14, 8781-8793, doi:10.5194/acp-14-8781-2014, 2014. 13, 31363-31407, 2014.

21. Camino C., Cuevas E., **Basart S.**, Alonso-Pérez S., Baldasano J.M, Terradellas E., B. Marticorena, Rodríguez S., and Berjón A.: An empirical equation to estimate mineral dust concentrations from visibility observations in Northern Africa, Aeolian Research, Aeolian Research, 16, 55-68, 2015.
22. Cuevas, E., Camino, C., Benedetti, A., **Basart, S.**, Terradellas, E., Baldasano, J. M., Morcrette, J.-J., Marticorena, B., Goloub, P., Mortier, A., Berjón, A., Hernández, Y., Gil-Ojeda, M., and Schulz, M.: The MACC-II 2007–2008 reanalysis: atmospheric dust evaluation and characterization over Northern Africa and Middle East, Atmos. Chem. Phys., 15, 3991-4024, doi:10.5194/acp-15-3991-2015, 2015.
23. Gama, C., Tchepel, O., Baldasano, J.M., **Basart, S.**, Ferreira, J., Pio, C., and Borrego, C.: Seasonal patterns of Saharan dust over Cape Verde – a combined approach using observations and modelling, Tellus B, 67, 24410, http://dx.doi.org/10.3402/tellusb.v67.24410, 2015.
24. Sessions, W. R., Reid, J. S., Benedetti, A., Colarco, P. R., da Silva, A., Lu, S., Sekiyama, T., Tanaka, T. Y., Baldasano, J. M., **Basart, S.**, Brooks, M. E., Eck, T. F., Iredell, M., Hansen, J. A., Jorba, O. C., Juang, H.-M. H., Lynch, P., Morcrette, J.-J., Moorthi, S., Mulcahy, J., Pradhan, Y., Razinger, M., Sampson, C. B., Wang, J., and Westphal, D. L.: Development towards a global operational aerosol consensus: basic climatological characteristics of the International Cooperative for Aerosol Prediction Multi-Model Ensemble (ICAP-MME), Atmos. Chem. Phys., 15, 335-362, doi:10.5194/acp-15-335-2015, 2015.

**Chapter in Books**

1. "Mineral dust – A key component in the Earth system", Springer Publishers, Editors: J.-B. Stuut and Peter Knippertz, Springer, 2014.

## Dr Louis-Philippe Caron

Carrer Dr Trueta 203, 3rd floor

Barcelona, 08005, Spain

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louis-philippe.caron@ic3.cat

**Education**

April 2011, Ph. D. in Atmospheric Sciences

Institut des sciences de l'environnement, UQAM, Montreal, Quebec

Advisor: Prof. Colin G. Jones

Co-advisor: Prof. René Laprise

Thesis: Simulation of Tropical Cyclones and African Easterly Waves in Low- and High-Resolution Climate Models.

September 2004, M. Sc. in Physics

York University, Toronto, Ontario

Advisor: Prof. Wayne Cannon

Thesis: An Estimate of the Lense-Thirring Effect in the Solar System and in a System of Binary Pulsars Using Delay of Light

**Indicators of Publication**

Total citations (last 5 years): 129 (126)

h-index: 5 (5)

i10-index: 3 (3)

**Research Grants**

CGL2014-55764-R; Regional Seasonal Forecasts and Multi-Annual Predictions of tropical cyclones. Awarded by Ministerio de Economía y Competitividad (MINECO)

From 01/01/2014 to 31/12/2015. Total amount: 33,000€.

RPI2.0-2013-CARON; Multi-annual forecasts of Atlantic tropical cyclones in a climate service context. Awarded by Risk Prediction Initiative.

From 01/11/2013 to 31/10/2014. Total amount: 55,000$.

**Professional Experience**

November 2013 – Present: Post-doctoral Fellow

Climate Forecasting Unit, Catalan Institute of Climate Sciences, Barcelona, Spain.

April 2011 – October 2013: Post-doctoral Fellow

Department of Meteorology, Stockholm University – Swedish Meteorological and Hydrological Institute (SMHI). Stockholm, Sweden.

2005 - Astronomy Teacher

Humber College, Toronto, Canada.

**Publications**

*Peer-reviewed articles*

Caron, L.-P., M. Boudreault and S. Camargo (2015) On the variability and predictability of eastern Pacific tropical cyclone activity. Submitted to Journal of Climate.

Caron, L.-P., L. Hermanson and F.J. Doblas-Reyes (2015) Multi-annual forecasts of Atlantic U.S. tropical cyclone wind damage potential. *Geophysical Research Letters*, **42**, 2417-2425. doi:10.1002/2015GL063303

Caron, L.-P., M. Boudreault and C. Bruyère (2015) Changes in large-scale controls of Atlantic tropical cyclone activity with the phases of the Atlantic Multidecadal Oscillation. *Climate Dynamics*, **44**, 1801-1821. doi:10.1007/s00382-014-2186-5.

Guemas, V., J. García-Serrano, A. Mariotti, F. Doblas-Reyes and L.-P. Caron (2015) Prospects for decadal climate prediction in the Mediterranean region. *Q.J.R. Meteorol. Soc.*, **687**, 580-597, doi:10.1002./qj.2379.

Caron, L.-P., C. Jones and F. J. Doblas-Reyes (2013) Multi-year prediction skill of Atlantic hurricane activity in CMIP5 decadal hindcasts. *Climate Dynamics*, **42**, 2675-2690. doi:10.1007/s00382-013-1773-1.

Caron, L.-P., C.G. Jones, P.A. Vaillancourt, and K. Winger (2013) On the relationship between cloud-radiation, atmospheric stability and Atlantic tropical cyclone activity in a variable-resolution climate model. *Climate Dynamics*, **40**, 1257-1269. doi: 10.1007/s00382-012-1311-6

Caron, L.-P. and C. G. Jones (2012) Understanding and simulating the link between African Easterly Waves and Atlantic Tropical Cyclones using a Regional Climate Model, 2011: The role of domain size and lateral boundary conditions. *Climate Dynamics*, **39**, 113-135. doi: 10.1007/s00382-011-1160-8

Caron, L.-P., C. G. Jones and K. Winger (2011) Impact of resolution and downscaling technique in simulating recent Atlantic tropical cyclone activity. *Climate Dynamics*, **5**, 869-892. doi: 10.1007/s00382-010-0846-7.

Caron, L.-P. and C. G. Jones (2008) Analysing present, past and future tropical cyclone activity as inferred from an ensemble of Coupled Global Climate Models. *Tellus*, **60A**, 80-96. doi: 10.1111/j.1600-0870.2007.00291.x

Zadra, A., D. Caya, J. Côté, B. Dugas, C. Jones, R. Laprise, K. Winger and L.-P. Caron (2008) The next Canadian Regional Climate Model. *Physics in Canada*, **64**, 75-83.

***Book Chapter***

Walsh, K., S. Lavender, H. Murakami, E. Scoccimarro, L.-P. Caron and M. Ghantous, 2010: The Tropical Cyclone Climate Model Intercomparison Project. Chapter in Hurricanes and Climate Change. 2nd edition. Springer.

***Technical Report***

Pintó, A., F. J. Doblas-Reyes, R. Vitolo and L.-P. Caron (2012) Predicción del riesgo de eventos de precipitación intensa en el Mediterráneo occidental y de la frecuencia de ciclones tropicales en el Atlántico a escala decadal. MAPFRE Fundacion. 49 pp.

***Theses***

Caron, L.-P. (2011) Simulation of Tropical Cyclones and African Easterly Waves in Low- and High-Resolution Climate Models. Ph.D. Thesis. Université du Québec à Montréal.

Caron, L.-P. (2004) An Estimate of the Lense-Thirring Effect in the Solar System and in a System of Binary Pulsars using Delay of Light. Master Thesis. York University.

***Selected non peer-reviewed articles***

L.-P. Caron and B. Boberg (2013) Overview of the Ability of the Canadian Regional Climate Model to Simulate recent North-Eastern Pacific Tropical Cyclone Activity. WGNE Blue Book. In press.

Caron, L.-P., C. G. Jones and F. J. Doblas-Reyes (2012) Atlantic Tropical Cyclone Activity in EC-Earth Full Field Initialized Decadal Forecasts. WGNE Blue Book. WGNE Blue Book, 6.03-6.04.

Caron, L.-P., C. G. Jones and K. Winger (2009) Simulating high-resolution Atlantic tropical cyclones using GEM: Part II. WGNE Blue Book. 7.03-7.04.

Caron, L.-P., C. G. Jones and K. Winger (2008) Simulating high-resolution Atlantic tropical cyclones using GEM-Climate. WGNE Blue Book. 7.05-7.06.

Zadra, A., D. Caya, J. Côté, B. Dugas, C. Jones, R. Laprise, K. Winger and L.-P. Caron (2008) The next Canadian Regional Climate Model. Physics in Canada, 64, 75-83. *(invited)*

Caron, L.-P. and C. Jones (2007) Analysis of cyclogenesis frequency in ERA40 reanalysis and in an ensemble of models. WGNE Blue Book, 9.01-9.02.

**Recent Conferences/Presentations**

Caron, L-P: Research Activity of the Climate Forecasting Unit at IC3. Presented at Ouranos, Montréal, Canada, March 31, 2015.

Caron, L-P, L. Hermanson and F. Doblas-Reyes: Multi-annual forecasts of Atlantic tropical cyclone wind damage. Joint SPECS-MiKlip workshop, Offenbach, 24 February 2015.

Caron, L-P, F. Doblas-Reyes and M. Boudreault: Multi-annual forecasts of Atlantic tropical cyclones in a climate service context. World Weather Open Science Conference, Montréal, Canada, August 16 - 21, 2014.

Caron, L.-P., C.G Jones and F. Doblas-Reyes: Statistical predictions of multi-annual North Atlantic hurricane activity in a series of CMIP5 decadal hindcasts. 4th International Summit on Hurricane and Climate Change. Kos, Greece. June 13-18, 2013.

Boudreault, M., L.-P. Caron and J.-P. Boucher: A re-analysis of North Atlantic hurricane activity with dynamic latent processes. 4th International Summit on Hurricane and Climate Change. Kos, Greece. June 13-18, 2013.

Caron, L.-P., C.G Jones and F. Doblas-Reyes: Multi-annual prediction skill of Atlantic hurricane activity in CMIP5 decadal hindcasts using a statistical index. International Workshop on Seasonal and Decadal Prediction. Toulouse, May 13-16, 2013.

Caron, L.-P., C.G Jones and F. Doblas-Reyes: Multi-annual predictions of hurricane activity: How does EC-Earth compare? EC-Earth annual meeting. Lisbon, April 16-17, 2013.

Caron, L.-P.: Decadal predictions of tropical cyclones in CMIP5 simulations. Annual Bert Bolin Center meeting. Stockholm, November 21-22, 2012.

Caron, L.-P.: Climate of the Month – Disaster Edition (September-October 2012). Internal IC3 presentation. Barcelona, November 2012.

Caron, L.-P.: On the difficulty of capturing recent Atlantic tropical cyclone activity with a Regional Climate Model. Canadian Meteorological and Oceanographic Society (CMOS). Montreal, May 29 – June 2, 2012. *(Invited)*

Caron, L.-P., C.G. Jones, F.J. Doblas-Reyes, and M. Caian: Multi-year forecast of Atlantic tropical cyclone activity using EC-Earth. European Geoscience Union General Assembly. Vienna, Austria, April 22-27, 2012.

Caron, L.-P.,: Impact of model configuration in simulating recent tropical cyclone activity using the Canadian regional climate model. 3rd International Summit on Hurricanes and Climate Change. Rhodes, Greece, June 29 – July 2, 2011.

Caron, L.-P., C.G. Jones and K. Winger: Impact of resolution and downscaling technique in simulating Atlantic tropical cyclone activity with GEM-Climate, 29th Conference on Hurricanes and Tropical Meteorology, Tuscon, Az., May 9-15, 2010.

**Supervision of Graduate Students**

Aug 2012 – Feb 2013: Bonnie Boberg (M.Sc.) – Simulation of Eastern Pacific Tropical Cyclone Activity using the Canadian Regional Climate Model

**Awards and Scholarships**

| | |
|---|---|
| 2008-2010 | Natural Sciences and Engineering Research Council (NSERC) Postgraduate Scholarships. 42.K$ |
| 2008-2010 | NSERC Meteorological Service of Canada Graduate Supplement. 10.K$ |
| 2007 | Bourse d'excellence Hydro-Quebec (UQAM) 6.K$ |
| 2006 | Bourse d'excellence Power Corporation (UQAM) 5.K$ |
| 2004 | Best Master Thesis – Physics, York University |
| 2003-2004 | Ontario Graduate Scholarship (OGS) 15.K$ |
| 2002-2003 | Ontario Graduate Scholarship in Science and Technology (OGSST) 10.K$ |

**Languages**

French - native

English - fluent

Spanish – conversational

## Dr María Gonçalves Ageitos

Associate Researcher at the Earth Sciences Department of the Barcelona Supercomputing Center - Centro Nacional de Supercomputación. Barcelona. Spain.

Interim professor at the Engineering Projects Department of the Technical University of

Catalonia. Terrassa. Spain.

ORCID record at http://orcid.org/0000-0003-3857-6403

ResearchGate https://www.researchgate.net/profile/Maria_Goncalves_Ageitos

**Education**

March, 2009

PhD in **Environmental Engineering,** with the PhD Thesis entitled **"Assessing variations in urban air quality when introducing on-road traffic management strategies by means of high resolution modeling. Application to Barcelona and Madrid"** Environmental Modeling Laboratory. Technical University of Catalonia. Barcelona (Spain).

October, 2006

Advanced Studies Diploma (DEA): **Urban air quality management and planning using atmospheric modeling.** Technical University of Catalonia. Barcelona (Spain)

September, 2004

**Chemical Engineering**. Santiago de Compostela University (Spain).

**Publications**

*Articles in peer-reviewed journals*


1. Gonçalves-Ageitos, M., Barrera-Escoda, A. Baldasano, J.M., Cunillera, J. (2015) Modeling wind resources in climate change scenarios in complex terrains. Renewable Energy 76, 670-678. doi: 10.1016/j.renene.2014.11.066
2. Barrera, A.; Gonçalves, M.; Guerreiro, D.; Cunillera, J.; Baldasano, J. (2014) Projections of temperature and precipitation extremes in the North Western Mediterranean Basin by dynamical downscaling of climate scenarios at high resolution (1971-2050). Climatic Change 122 (4), 567 - 582. doi: 10.1007/s10584-013-1027-6
3. Gonçalves, M.; Barrera, A.; Guerreiro, D.; Baldasano, J.; Cunillera, J. (2014) Seasonal to yearly assessment of temperature and precipitation trends in the North Western Mediterranean Basin by dynamical downscaling of climate scenarios at high resolution (1971-2050). Climatic Change. 122, 243 - 256. doi: 10.1007/s10584-013-0994-y
4. Gonçalves, M., Dabdub, D.; Chang, W.L.; Jorba, O.; Baldasano, J.M. (2012) Impact of HONO sources on the performance of mesoscale air quality models. Atmospheric Environment 54, 168-176. doi: 10.1016/j.atmosenv.2012.02.079.
5. Gonçalves, M.; Dabdub, D.; Chang, W.L.; Jorba, O.; Saiz, F.; Baldasano, J.M. (2010) The impact of different nitrous acid sources in the air quality levels of the Iberian Peninsula. Atmospheric chemistry and physics discussions 10, 28183-28230. doi:10.5194/acpd-10-28183-2010
6. Jorba, O.; Dabdub, D.; Blaszczak-Boxe, C.; Pérez, C.; Janjic, Z.; Baldasano, J.M.; Spada, M.; Badia, A.; Gonçalves, M. (2012). Potential significance of photoexcited NO2 on global air quality with the NMMB/BSC chemical transport model. Journal of Geophysical Research 117 (13), 1-16. doi: 10.1029/2012JD017730
7. Pay, M.T., Piot, M., Jorba, O., Gassó, S., Gonçalves, M., Basart, S., Dabdub, D., Jiménez-Guerrero, P., Baldasano, J.M. (2010). A full year evaluation of the CALIOPE-EU air quality modeling system over Europe for 2004 .Atmospheric Environment, 44 (27): 3322-3342, doi:10.1016/j.atmosenv.2010.05.040, ISSN:1352-2310.
8. Baldasano, J.M., Gonçalves, M., Soret , A., Jiménez-Guerrero, P. (2010). Air pollution impacts of speed limitation measures in large cities: The need for improving traffic data in a metropolitan area. Atmospheric Environment, 44 (25): 2997-3006, doi:10.1016/j.atmosenv.2010.05.013, ISNN:1352-2310.
9. Gonçalves, M., Jiménez-Guerrero, P., López, E., Baldasano, J.M. (2008). Air quality models sensitivity to on-road traffic speed representation. Effects on air quality of 80 km h-1 speed limit in the Barcelona Metropolitan area. Atmospheric Environment 42, 8389-8402. doi:10.1016/j.atmosenv.2008.08.022
10. Gonçalves, M., Jiménez-Guerrero, P., Baldasano, J.M. (2009). Contribution of atmospheric processes affecting the dynamics of air pollution in South-Western Europe during a typical summertime photochemical episode. Atmospheric Chemistry and Physics 9, 849–864.
11. Gonçalves, M., Jiménez-Guerrero, P., Baldasano, J.M. (2009). Emissions variation in urban areas resulting from the introduction of natural gas vehicles: application to Barcelona and Madrid Greater Areas (Spain). Science of the Total Environment 407, 3269-3281. doi:10.1016/j.scitotenv.2009.01.039.
12. Gonçalves, M., Jiménez-Guerrero, P., Baldasano, J.M. (2009). High-resolution modeling of the effects of alternative fuels use on urban air quality: Introduction of natural gas vehicles in Barcelona and Madrid Greater Areas (Spain). The Science of the Total Environment 407, 776-790. doi:10.1016/j.scitotenv.2008.10.017

*Books/Chapters in books*

1. Calbó, J., Cunillera, J., Barrera-Escoda, A., Doblas-Reyes, F., Guemas, V., García-Serrano, J., Gonçalves, M. Chapter 5 on Climate projections and future scenarios. Third Catalan Report on Climate Change. Under preparation.
2. Baldasano J.M, Gonçalves M, Jiménez P. (2005). "A review of background air quality trends in Europe using EMEP data". In: Air Pollution XIII. Edited by: C.A. Brebbia, Wesex Institute of Technology, UK. 129-138. ISBN: 1-84564-014-4
3. Baldasano J.M., J. Plana, M. Gonçalves, P. Jiménez, O. Jorba, E. López (2007) Air quality improvement by natural gas vehicles introduction. Application to Barcelona and Madrid Edited by Fundación Gas Natural, September 2007. 85 pp. ISBN: 978-84-611-8540-5
4. Gonçalves M., Jiménez-Guerrero, P., Baldasano, J.M., (2008). Air Quality Management Strategies in Large Cities: Effects of Changing the Vehicle Fleet Composition in Barcelona and Madrid Greater Areas (Spain) by Introducing Natural Gas Vehicles. C. Borrego and A.I. Miranda (eds.), Air Pollution Modeling and Its Application XIX. Springer Science + Business Media B.V. 2008. ISSN: 1874-6519. ISBN: 978-1-4020-8452-2
5. Gonçalves, M., Jiménez, P., Baldasano, J.M. (2010). Alternatives for a cleaner air in urban areas. A modeling study. VDM Verlag Dr Müller. Saarbrüken (Alemania) 283 pp. ISBN: 9783639247664

*Technical Reports*

1. Baldasano J.M., M. Gonçalves, P. Jiménez, R. Parra (2005) "Estimation of energy consumption and $CO_2$ emissions associated to the PVC, HDPE, PP, cast-iron and concrete pipes production, use and final disposal": PVC-Tub-200512-2, December, 70 pp.
2. Baldasano J.M., M. Gonçalves, P. Jiménez (2005) "Estimation of energy consumption and $CO_2$ emissions associated to the P-PVC, EPDM and bituminous sheets production, use and final disposal" PVC-Lam-200511-2, November, 34 pp.
3. Baldasano J.M., M. Gonçalves, P. Jiménez (2005) "Estimation of energy consumption and $CO_2$ emissions associated to the PVC, XLPE and PE cables production, use and final disposal" PVC-Cab-200511-2, November, 30 pp.
4. Baldasano J.M., J. Plana, M. Gonçalves, P. Jiménez, O. Jorba, E. López (2007) "Air quality improvement by natural gas vehicles introduction. Application to Barcelona and Madrid" Edited by Fundación Gas Natural. ISBN: 978-84-611-8540-5, September 2007. 85 pp.

**Research projects**

*Competitive calls*

"Prediction and assessment of the aerosols radiative forcing for meteorological and climatic applications with the on-line model NMMB/BSC-CTM" Funded by: RETOS-2014. Economy and competitiveness Ministry. Spanish Government. Ref: CGL2013-46736-R. PI: O. Jorba. Duration: 36 months,starting in January 2014. Role: *researcher*.

"Assembly and Implementation of an Operational Air Quality Forecast for the Iberian Peninsula". Funded by: Innovation and Science Ministry. Spanish Government. Spain-Portugal Integrated Actions Subprogram. Participating Institutions: BSC-CNS, Technical University of Catalonia, Universidade de Aveiro. PI: J.M. Baldasano. Duration: 48 months, from 2008 to 2011. Role: *researcher*.

"Use of virtual people avatars for students tutoring". Funded by: University and Research Support Management Agency (AGAUR). Participating Insitutions: Technical University of Catalonia. PI: B. Amante García. Duration: 24 months, from 2011 to 2013. Role: *researcher*.

"Subject coordination for the introduction of a third language as a generic ability at the new degree studies from the Industrial and Aerospace Engineering School of Terrassa". Funded by: University and Research Support Management Agency (AGAUR). Participating Institutions: Technical University of Catalonia. PI: D. García. Duration: 24 months, from 2011 to 2013. Role: *researcher*.

*Grants*

Mobility grant to develop the project: "Radiative effect due to aerosol-radiation interactions on the Mediterranean climate", funded by EEA/NILS Science and Sustainability program. Host organization: Norwegian Meteorological Institute. Duration: 3 months, starting in April 2015.

*Collaboration agreements*

Regional climate modeling. Funded by: BSC-CNS. Participating Institutions: Technical University of Catalonia. PI: M. Gonçalves-Ageitos. Duration: 6 months, from January to June 2012.

Operational air quality forecast. Funded by: BSC-CNS. Participating Institutions: Technical University of Catalonia. PI: M. Gonçalves-Ageitos. Duration: 16 months, from January 2009 to July 2010.

Energy consumption and CO2 emissions associated to the use of PVC and alternative materials in different constructive elements: windows, wires, pipes and impermeabilization sheets. Funded by: Solvay Iberica. Participating Institutions: Technical University of Catalonia. PI: J.M. Baldasano. Duration: 15 months, from September 2005 to December 2006. Role: *researcher*.

Estimation of the urban air quality change due to the introduction of natural gas as a fuel: application to Barcelona and Madrid. Funded by: Gas Natural SDG. Participating Institutions: Technical University of Catalonia. PI: J.M. Baldasano. Duration: 12, from January 2007 to January 2008. Role: *researcher*.

*Other projects*

Collaboration to the Coordinated Regional Climate Downscaling Experiment (Med-CORDEX), organized by the WRCP, from January 2014.

Collaboration with the EC-Earth project, coordinated by KNMI, from 2006.

Participation in the Organization of the Second European Earth System and Climate Modeling School: 2nd E2SCMS, held in Barcelona from June 9 to 20, 2014, within the framework of the IS-ENES2 European Project.

**Relevant conference contributions (since 2009)**

Gonçalves, M., Jiménez-Guerrero, P., Baldasano, J.M., 2009. Comparative analysis of natural gas, biodiesel and hybrid cars use in Madrid and Barcelona (Spain). Searching the improvement of the air quality. In: ETTAP 2009, 17th Transport and Air Pollution symposium & 3rd Environment and Transport Symposium. Toulouse, France, 2-4 June, 2009.

Baldasano, J.M., Jiménez-Guerrero, P., López, E., Gonçalves, M., 2009. Effects on air quality of 80 km h-1 speed limit in the air quality of the Barcelona Metropolitan Area (Spain). In: ETTAP 2009, 17th Transport and Air Pollution symposium & 3rd Environment and Transport Symposium. Toulouse, France, 2-4 June, 2009.

Baldasano, J.M., Jiménez-Guerrero, P., López, E., Gonçalves, M., 2009. Air quality models sensitivity to on-road traffic speed representation. Effects on air quality of 80 km h-1 speed limit in the Barcelona Metropolitan Area. In: 30th NATO/SPS International Technical Meeting on Air Pollution Modelling and its Application. San Francisco, USA, 18-22 May, 2009.

Gonçalves, M., Jiménez-Guerrero, P., Baldasano, J.M.; 2009. Using atmospheric modelling for urban air quality management: Barcelona and Madrid case study. Monterrey Technical University. Toluca, Mexico, 30 June, 2009.

Gonçalves, M.; Piot, M.; Jorba, O., Pay, M. T.; Gassó, S.; Baldasano, J.M., 2009. Operational evaluation system of the Spanish air quality forecasting model CALIOPE. In: 22nd ACCENT/GLOREAM workshop on tropospheric chemical transport modelling. Brescia, Italy, 26-27 November 2009.

Gonçalves, M.; Piot, M.; Jorba, O.; Pay, M.T.; González, L.; Gassó, L.; Baldasano, J.M.; 2010. Near real time evaluation system of the Spanish air quality forecasting model CALIOPE. In: EGU General Assembly 2010. Vienna, Austria, 2-7 May 2010.

Baldasano, J. M., Piot, M., Jorba, O., Gonçalves, M.; Pay, M. T.; Pérez, C., López, E., Gassó, S.; Martín, F., García-Vivanco, M., Palomino, I., Querol, X., Pandolfi, M., Diéguez, J.J., Padilla, L., 2009. Operational air quality forecasting system for Spanish CALIOPE. As a poster in: AGU Fall Meeting – San Francisco – 14/18 December 2009.

Piot , M., Pay, M. T., Jorba, O., Basart, S., Gassó, S., Gonçalves, M., González, L., Querol, X, Pandolfi, M., Alastuey, A., Dabdub, D., Baldasano, J.M., 2010. Chemical composition of particulate matter in Spain: modelling evaluation of the CALIOPE system for 2004. In: EGU General Assembly 2010. Vienna, Austria, 2-7 May 2010.

Gonçalves, M., Piot, M., Jorba, O., Pay, M.T., González, L., Gassó, S., Baldasano, J.M., 2010. Near real time evaluation system of the Spanish air quality forecasting model CALIOPE. HARMO13 13$^{th}$ international conference on harmonisation within atmospheric dispersion modelling for regulatory purposes. Paris, France, 1 -4 June 2010.

Baldasano J.M., Piot, M., Jorba, O., Goncalves, M., Pay, M.T., Basart, S., Jimenez P., Gassó, S., 2010. CALIOPE: an Operational Air Quality Forecasting System for Europe and Spain. Mesoscale Modelling For Air Pollution Applications: Achievements And Challenges (COST 728 Final Workshop), Organisers: COST 728, WMO/GURME and MEGAPOLI, Geneva, (Switzerland) 25-26 February

Gonçalves-Ageitos, M., Chang W.L., Dabdub, D., Jorba, O., Baldasano J.M., 2011. Impact of HONO sources in the air quality levels of the Iberian Peninsula. 23th GLOREAM ERUASAP workshop on tropospheric chemical transport modelling. Copenhagen, Dinamarca, 26-28 Enero 2011. Ponencia.

Gonçalves, M., Barrera, A., Cunillera, J., Baldasano, J.M., 2014. Modelització dels recursos eòlics sota escenaris de canvi climàtic a Catalunya. 6a Jornada anual d'actualització de coneixements sobre el canvi climàtic a Catalunya. Os de Balaguer, España.

Gonçalves, M., Barrera, A., Cunillera, J., Baldasano, J., 2013. Dynamical downscaling of climatic temperature and precipitation trends for the North Western Mediterranean Basin at high resolution. CORDEX 2013. Bruselas, Bélgica.

Gonçalves, M., Barrera, A., Guerreiro, D., Cunillera, J., Baldasano, J.M., 2013. Temperature and precipitation trends for the North Western Mediterranean Basin as derived from dynamical downscaling of climate scenarios. 4th International Meeting on Meteorology and Climatology of the Mediterranean. Banyuls, Francia.

Gonçalves, M., Barrera-Escoda, A., Baldasano, J., Cunillera, J., 2012. High-resolution climate scenarios by dynamic downscaling modelling techniques over the Northwestern Mediterranean Basin. 12th EMS Annual Meeting. Lódz, Polonia.

Barrera-Escoda A., M. Gonçalves, J. Cunillera, J.M. Baldasano, 2014. Projeccions climàtiques futures regionalitzades a Catalunya a alta resolución. XX Jornades de Meteorología Eduard Fontseré (JEF) 2014, ACAM-COSMOCAIXA, Barcelona 29 Noviembre

**Work experience**

*Current positions:*

Interim professor. Engineering Projects Department. Technical University of Catalonia. Terrassa. Spain. (Since September 2013)

Associate Researcher. Earth Sciences Department. Barcelona Supercomputing Center – Centro Nacional de Supercomputación. Barcelona. Spain. (Since March 2009)

*Previous positions:*

Lecturer professor. Projects Engineering Department. Technical University of Catalonia. Terrassa (Spain). (September 2010 - August 2013)

Assistant professor. Engineering Projects Department. Technical University of Catalonia. Terrassa (Spain). (October 2005 - August 2010)

Postdoctoral short stay at the Mechanical and Aerospace Engineering Department of the University of California – Irvine (U.S.). Project: “Modeling nitrous acid sources and its impacts on the air quality levels of the Iberian Peninsula”. (March 2010 - July 2010)

# Enza Di Tomaso

Barcelona Supercomputing Center - Nexus II,
Jordi Girona, 29, 08034 Barcelona, Spain
enza.ditomaso@gmail.com


## WORK EXPERIENCE

1 Jun 2013–Present

### Postdoctoral Researcher

Earth Sciences Department, Barcelona Supercomputing Center (BSC), Barcelona, Spain

Development of data assimilation capability for the BSC in-house developed chemical transport model using an ensemble-based technique and observations from ground-station and satellite-orbiting sensors. This required the creation of an ensemble of model runs obtained perturbing uncertain model parameters, observation error statistics and quality control handling, definition of observation operators and construction of diagnostic tools for the data assimilation system.

1 Mar 2010–28 Feb 2013

### Satellite Section Consultant (EUMETSAT fellow)

ECMWF, Reading, United Kingdom

Routine monitoring and assessment of the quality of radiance products from ATOVS sensors (AMUS-A, AMSU-B/MHS, HIRS) on different polar-orbiting satellites, and update of their assimilation in line with operational system changes;

Enhancement of the assimilation of ATOVS radiances in the ECMWF system including the improvement of quality control procedures, observation errors, bias correction, emissivity estimation and development towards the assimilation of data sensitive to surface emission over land, ocean, sea-ice;

Preparation for new instruments: implementation and initial evaluation of AMUS-A, MHS and HIRS sensors onboard Metop-B satellite.

1 Oct 2006–28 Feb 2010

### Research Fellow

Institute of Methodologies for Environmental Analysis of the Italian National Research Council (IMAA/CNR), Tito, Potenza, Italy

Development of a novel algorithm for rain rate retrieval using satellite-based observations from the AMSU-B sensor; Analysis of microwave sounder radiances in the presence of hydrometers; Use of scattering radiative transfer code in the microwave spectral region.

1 Oct 2004–31 Jul 2006

### Lecturer in Artificial Intelligence and Discrete Mathematics

Engineering Mathematics Department, University of Bristol, Bristol, United Kingdom

Lecturer and organiser of the following units and exams: Knowledge Representation & Uncertainty (Master level), Non-linear Optimisation and Dynamic Programming (year 3); Logic & Information (year 2); Discrete Mathematics (year 1).

Organiser of the Artificial Intelligence Group seminars, and librarian representative;

Student tutor and interviewer of prospective students.

## ADDITONAL WORK EXPERIENCE

12 Jul 2009–18 Jul 2009

### Tutor in the International Summer School on Applications with the Newest Multispectral Meteorological Satellites

IMAA/CNR, Tito, Potenza, Italy

Assisting Prof. P. Menzel (University Wisconsin-Madison) in laboratory exercises on the investigation

of high spatial resolution visible and infrared data (MODIS and SEVIRI), high spectral resolution infrared data (AIRS and IASI), and microwave sounding data (AMSU).

1 Oct 2000–30 Jun 2004

### Graduate Teaching Assistant

Engineering Mathematics Department, University of Bristol, Bristol, United Kingdom

Student demonstrator in example classes of Discrete Mathematics, Probability & Statistic and Numerical Methods, Engineering Mathematics.

1 Feb 2004–31 May 2004

### Visiting Lecturer

Humanities, Languages and Social Sciences Department, University of the West of England, Bristol, United Kingdom

Responsible and lecturer of the module Italian Level 1+.

1 Sep 2000–30 Sep 2000

### Student Placement

Intelligent Systems Lab, BT Exact, Ipswich, United Kingdom

Development of a web visitor profiling using Bayesian networks.

## EDUCATION AND TRAINING

1 Oct 2000–14 Dec 2004

### PhD in Engineering Mathematics

University of Bristol, Bristol, United Kingdom

Thesis title: Soft Computing for Bayesian Networks.

Research topic: A development of a theory on Bayesian networks that could handle uncertainty, supported by the development of algorithms for probabilistic inference and database processing, and applications in supervised learning, classification and state estimation problems.

1 Oct 1994–16 Mar 2000

### Laurea (MSc) in Physics

Grade: 110/110.

University of Bologna, Bologna, Italy

Final thesis title: Fril and its Applications in Machine Learning.

Research topic: Application of logic rules to pattern recognition problems using the logic programming language Fril.

## ADDITIONAL TRAINING

11 Dec 2014–12 Dec 2014

### Certificate of Participation to the PRACE Advanced Training Centres Course on Introduction to Simulation Environment for Earth Sciences

PATC at BSC, Barcelona, Spain

Topics: Build, run, and visualize a collection of Earth Sciences numerical models within an HPC environment.

7 Jul 2008–18 Jul 2008

### Certificate of Participation to the Summer School on Parallel Computing

Cineca - Consortium of Universities, Bologna, Italy

Topics: Introduction to MPI (Message Passing Interface) and OpenMP (Open Multiprocessing) application programming interface.

3 Jul 2007–13 Jul 2007

Certificate of Participation to the International Summer School on Applications with the Newest Multi-spectral Meteorological Satellites

Mediterranean Agency for Remote Sensing, Benevento, Italy

Topics: Radiation and the Radiative Transfer Equation, spectral signatures from Earth's surface and atmosphere, high resolution infrared sounding, and multi-spectral sensors for imaging.

## PERSONAL SKILLS

Mother tongue: Italian

Other languages

| | UNDERSTANDING | | SPEAKING | | WRITING |
|---|---|---|---|---|---|
| | Listening | Reading | Spoken interaction | Spoken production | |
| English | C2 | C2 | C2 | C2 | C2 |
| Spanish | B2 | B2 | B2 | B2 | A2 |
| German | A2 | A2 | A2 | A2 | A1 |

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user

Common European Framework of Reference for Languages

Computer skills: Good knowledge of Fortran, Python and shell scripts. Basic skills in R and C.
User-level knowledge of the Perforce revision control system.
Good knowledge of Linux (user-level). Familiar with Mac OS X and Windows.
Good command of LaTeX and MS Office tools.Good command of tools for satellite applications: AAPP (ATOVS processing package), GMT mapping tool. Good command of ECMWF's meteorological tools: Metview (access, manipulation and visualisation of meteorological data), PrepIFS (preparation of research experiments using the Integrated Forecasting System - IFS), MARS (access to the meteorological data archive).

## PUBLICATIONS

Journal Papers

E. Di Tomaso, F. Romano, V. Cuomo, Rainfall Estimation from Satellite Passive Microwave Observations in the Range 89 GHz to 190 GHz, Journal of Geophysical Research, vol. 114, 2009.

E. Di Tomaso, J.F. Baldwin, An Approach to Hybrid Probabilistic Models, International Journal of Approximate Reasoning, vol 47, 202-218, 2008.

E. Di Tomaso, J.F. Baldwin, Effective Database Processing for Classification and Regression with Continuous Variables, International Journal of Intelligent Systems, vol 22, 1271-1285, 2007.

Book Contribution

F. Romano, E. Di Tomaso, T. Montesano, E. Ricciardelli, V. Cuomo, E. Geraldi, Microfisica delle nubi e loro impatto sul clima. In: B. Carli, G. Cavarretta, M. Colacino, S. Fuzzi, Clima e Cambiamenti Climatici, ed. Consiglio Nazionale delle Ricerche, Roma, Italia, 2007

Reports

S. English, T. McNally, N. Bormann, K. Salonen, M. Matricardi, A. Horanyi, M. Rennie, M. Janisková, S. Di Michele, A. Geer, E. Di Tomaso, C. Cardinali, P. de Rosnay, J. Muñoz Sabater, M. Bonavita, C. Albergel, R. Engelen and J.-N. Thépaut, Impact of satellite data. ECMWF Technical Memorandum, 711, 46 pp, 2013.

E. Di Tomaso, N. Bormann and S. English, Assimilation of ATOVS radiances at ECMWF: third year EUMETSAT fellowship report, EUMETSAT/ECMWF Fellowship Programme Research Report No 29, 2013.

E. Di Tomaso, N. Bormann, Evaluation of Metop-B microwave sounders: AMSU-A and MHS, ECMWF Technical Report No RD64, 2012.

E. Di Tomaso, N. Bormann, Assimilation of ATOVS radiances at ECMWF: second year EUMETSAT fellowship report, EUMETSAT/ECMWF Fellowship Programme Research Report No 26, 2012.

E. Di Tomaso, N. Bormann, Assimilation of ATOVS radiances at ECMWF: first year EUMETSAT fellowship report, EUMETSAT/ECMWF Fellowship Programme Research Report No 22, 2011.

E. Di Tomaso, N. Bormann, ATOVS Observing System Experiments: on the performance of three satellites in evenly-spaced orbits, ECMWF Technical Report No 1095, 2010.

E. Di Tomaso, N. Schutgens and O. Jorba, Measurements or computer simulations: to whom do we turn for atmospheric composition estimates? Proc. 2nd BSC International Doctoral Symposium,

| | |
|---|---|
| | Barcelona, Spain, 2015. |
| | H. Lawrence, N. Bormann, E. Di Tomaso, S. English, Situation-dependent observation errors for AMSU-A tropospheric channels in the ECMWF forecasting system. Proc. 19th International TOVS Study Conference, Jeju Island, South Korea, 2014. |
| Conference Papers | E. Di Tomaso, N. Schutgens, J. Oriol and G.S. Markomanolis, Data assimilation enhancement of a chemical transport model: a dust forecast application. Proc. 2014 EUMETSAT Meteorological Satellite Conference, Geneva, Switzerland, 2014. |
| | E. Di Tomaso, N. Bormann and S. English, Extending the use of microwave sounding data over sea-ice in the ECMWF system, Proc. EUMETSAT Meteorological Satellite Conference, Vienna, Austria, 2013. |
| | E. Di Tomaso, N. Bormann, Extending the use of surface-sensitive microwave channels in the ECMWF system, Proc. EUMETSAT Meteorological Satellite Conference, Sopot, Poland, 2012. |
| | E. Di Tomaso, N. Bormann, Correction of errors in the simulation of AMSU-A observations, Proc. 18th International TOVS Study Conference, Toulouse, France, 2012. |
| | E. Di Tomaso, N. Bormann, The assimilation of surface-sensitive microwave sounder radiances at ECMWF, Proc. 18th International TOVS Study Conference, Toulouse, France, 2012. |
| | E. Di Tomaso, N. Bormann, Assimilation of ATOVS radiances at ECMWF, Proc. EUMETSAT Meteorological Satellite Conference, Oslo, Norway, 2011. |
| | E. Di Tomaso, N. Bormann, Observing system experiments on ATOVS orbit constellations, Proc. EUMETSAT Meteorological Satellite Conference, Oslo, Norway, 2011. |
| | E. Di Tomaso, F. Romano, V. Cuomo, A novel algorithm for rain rate retrieval using AMSU-B observations, Proc. 4th IPWG Workshop on Precipitation Measurements, Beijing, China, 2008. |
| | F. Romano, D. Cimini, E. Di Tomaso, E. Ricciardelli and V. Cuomo, Analysis of Artic clouds by means of hyper-spectral satellite, Proc. 16th International TOVS Study Conference, Angra dos Reis, Brazil, 2008. |
| | J.F. Baldwin, E. Di Tomaso, Bayesian Networks for Continuous Values and Uncertainty in the Learning Process, Proc. EUSFLAT, Zittau, Germany, 2003. |
| | J.F. Baldwin, E. Di Tomaso, Bayesian Networks for Inference and State Estimation Problem Under Uncertainty, Proc. EUNITE, Oulu, Finland, 2003. |
| | J.F. Baldwin, E. Di Tomaso, Inference and Learning in Fuzzy Bayesian Networks, Proc. FUZZ-IEEE, St. Louis, MO, 2003. |
| | J.F. Baldwin, E. Di Tomaso, Modified Algorithm for Fuzzy Bayesian Networks Inference, Proc. IPMU, Annecy, France, 2002. |

# Dr Isadora Christel Jiménez García

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Isadora.jimenez@bsc.es

Isadora.jimenez

Sex Woman | Date of birth 15/08/1981 | Nationality Spanish


## WORK EXPERIENCE

April 2015 - present

### Communication and Project manager

Barcelona Supercomputing Center (BSC-CNS) – Earth Sciences Department

- End-user interaction for technology transfer promotion
- Research outputs dissemination
- Public engagement activities
- Deliverables preparation within European projects
- Workpackage coordination

Business or sector Earth Sciences research

October 2013 – May 2015

### Communication manager

Barcelona Alzheimer Treatment & Research Center (Fundació ACE). Barcelona

- Press office
- Social media management
- Conference and other scientific events organization
- Public engagement activities
- Dissemination and public engagement support for EU funded project RAMCIP (H2020)

Business or sector Health

March 2012 – May 2015

### Freelance communication consultant

Validated ID s. l. (www.validatedid.com). Barcelona

- Graphic design services for printed and on-line materials
- Video editing for product demos

Business or sector IT

December 2012 – May 2013

### Communication project manager

University of Barcelona (UB). Barcelona

- Coordination of the Marine Renewable Energies outreach project “Les Energies del Blau”

Business or sector Energetic sector

April 2012 – September 2012

### Communication project assistant

ADELPHI s. a. (www.adelphi.es). Barcelona

- Organizing focus groups
- Writing specialised dissemination content

Business or sector Health

June 2008 – December 2012

### Researcher, PhD Student

University of Barcelona (UB). Barcelona

- Thesis project on offshore wind energy impact assessment
- Ecological modelling, Strategic Environmental Assessment, Environmental Impact Assessment, Vulnerability and Sensitivity Index

Business or sector Energetic sector / Environment

January 2012 – February 2012

### Visiting Researcher

Institute of Marine Research (IMR), Tromsø, Norway.

Business or sector Energetic sector / Environment

September 2009 – Sept. 2009

### Visiting Researcher

Norwegian Institute for Nature Research (NINA), Trondheim, Norway

Business or sector Energetic sector / Environment

August 2004 – May 2008

### Research assistant

Capital Energy Offshore s.l. & Fundació Bosch & Gimpera

- Consulting services for the Environmental impact assessment of the offshore wind farm “Tarragona” in the Ebro Delta
- Methodological design
- Technical spatial analysis
- Report writing

Business or sector Energetic sector / Environment

## EDUCATION AND TRAINING

2008-2012

### Doctor of Philosophy, Biodiversity

University of Barcelona (UB)

Title: Offshore wind energy and birds: Integrating assessment tools in space and time

2011

### Master’s degree in Scientific, Medical and Environmental Communication

University Pompeu Fabra's Institute of Continuing Education (UPF-IDEC). Barcelona

2004 **Bachelor's degree in Biology**

University of Barcelona (UB)

## PERSONAL SKILLS

**Mother tongue(s)** Spanish, Catalan

**Other language(s)**

| | UNDERSTANDING | | SPEAKING | | WRITING |
|---|---|---|---|---|---|
| | Listening | Reading | Spoken interaction | Spoken production | |
| ENGLISH | C1 | C1 | C1 | C1 | C1 |
| FRENCH | A2 | B1 | A1 | A1 | A1 |

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user

Common European Framework of Reference for Languages

**Communication skills**

- Advanced graphic design skills gained through intensive use of Illustrator and InDesign during the PhD studies
- Proficient use of Power point for presentations and posters gained in both research and communication professional experience.
- Good oral communication skills acquired by giving university lectures, conferences and seminars.
- Excellent writing skills adapted to different target audiences
- Practical experience as press officer gained as communication manager of the Barcelona Alzheimer Treatment & Research Center
- Strategic and operational knowledge on social networks.

**Organisational / managerial skills**

- Experience in organization of scientific conferences (9$^{th}$ Barcelona-Pittsburgh Biennial conference), workshops and Open House activities.
- Leadership (I have coordinated a team of up to 5 people)
- Experience in collaborative tasks within European Funded projects (GPWind, RAMCIP, EUPORIAS)

**Computer skills**

- Advanced user of Illustrator, InDesign, Photoshop
- Intermediate user of Premiere for video edition
- Advanced user of ArcGIS for spatial data visualization
- Advanced user of R and other statistic packages
- Experience in ACCESS Data Bases.
- Good command of Microsoft Office™ tools

**Driving licence**

- B

## ADDITIONAL INFORMATION

### Publications

Relevant publications related to the wind power sector and the environment:

- G. Certain, L. Jorgensen, **I. Christel**, B. Planque, V. Bretagnolle (2015) Mapping the vulnerability of animal community to pressure in marine systems: disentangling pressure types and integrating their impact from the individual to the community level. ICES J. Mar. Sci. doi: 10.1093/icesjms/fsv003
- **I. Christel**, G. Certain, A. Cama, D. Vieites i X. Ferrer (2013) Seabird aggregative patterns: A new tool for offshore wind energy risk assessment. *Marine Pollution Bulletin,* 66:84–91
- **I. Christel** (2012) Offshore wind energy and birds: Integrating assessment tools in space and time. Doctoral Thesis. University of Barcelona. (available at www.tdx.cat/handle/10803/107961)
- **I. Christel** y A. Cama (2010) Estudis d'impacte de futurs parcs eòlics marins sobre les aus. Book Chapter in: Història Natural dels Països Catalans, vol.12. Enciclopèdia Catalana, Barcelona.

Other publications:

- A. Cama, J. Bort, **I. Christel**, D. Vieites i X. Ferrer (2013) Fishery management has a strong effect on the distribution of the threatened Audouin's gull. *Marine Ecology Progress Series* 434: 279-286
- C. Martinez, X. Ferrer, R. Borràs, **I. Christel**, A. Cama. (2013) Records of Great Bustards Otis tarda in the Balearic Islands during the 19th century. Revista Catalana d'Ornitologia, 29:70-74
- A. Cama, R. Abellana, **I. Christel**, X. Ferrer i D. Vieites (2012) Living on predictability: modeling the density distribution of efficient foraging seabirds. *Ecography*, 35:912-921
- **I. Christel**, J. Navarro, M. del Castillo, A. Cama i X. Ferrer (2012) Foraging movements of Audouin's gull (Larus audouinii) in the Ebro Delta, NW Mediterranean: a preliminary satellite-tracking study. *Estuarine, Coastal and Shelf Science*, 96:257-261

### Conferences

Relevant conferences related to the wind power sector and the environment:

- **I. Christel**, G. Certain, A. Cama, D. Vieites i X. Ferrer. Aves marinas y parques eólicos offshore: cuantificación de la respuesta agregativa en aves marinas con propósitos de manejo. I Congreso Ibérico sobre Energía Eólica y Conservación de fauna. Jerez de la Frontera, España. 2012
- **I. Christel**, G. Certain, A. Cama, D. Vieites i X. Ferrer. Quantifying aggregative response in animal distribution for management purposes: Seabirds in the Ebro Delta. Integrative Biology and Global Change workshop. Ventorrillo, Madrid, España. 2011
- **I. Christel**, A. Cama i X. Ferrer. *Windfarm Sensitivity Index (WSI) used on a small-scale context*. International scientific meeting on marine renewable energy and the environment (MAREE 2008). Royal Institution of Great Britain, London, UK. 2008

Other conferences: participation in up to 6 conferences on offshore distribution of seabirds.

### Presentations & Seminars

- Invited speaker to present the EU Funded project Good Practice in Wind to stakeholders. Palau Robert, Barcelona (2012)
- Lecturer for undergraduate Biogeography, Zoology and Conservation Biology courses at the University of Barcelona (2008-2012)
- Responsible for GIS seminars for graduate students within the Master in Biodiversity at the University of Barcelona (2007-2012)

### Grants and awards

- PhD Scholarship from the University of Barcelona (2008-2012)
- Research grant from the University of Barcelona for collaboration in the project: "Environmental impact assessment of the offshore wind farm Tarragona in the Ebro Delta" (2005-2006)
- ICO award for Ornithological research 2005.
- Undergraduate internship grant from the University of Barcelona for the project "Design of interactive systems for the educative research on sciences" (2003)

### Memberships

- Member of ACCC (Catalan Association for Science communicationAssociació Catalana de Comunicació Científica)
- Member of INORE (International Network on Offshore Renewable Energy)

## Enric Terradellas Jubateny

### A. PERSONAL DETAILS

Name: Enric Terradellas Jubanteny

Nationality: Spanish

National ID card number: 77094412E

Date of birth: 2 September 1958

### B. PROFESSIONAL DETAILS

Employer: State Meteorological Agency of Spain

Current position: Territorial Delegation in Catalonia. Head of R&D Unit (permanent position)

Address: carrer de l'Arquitecte Sert, 1; 08005 Barcelona

Phone: +34 934137612

E-mail: eterradellasj@aemet.es

### C. PROFESSIONAL DUTIES

Technical Director of the Regional Center for Northern Africa, Middle East and Europe of the WMO Sand and Dust Storm – Warning Advisory and Assessment System (http://sds-was.aemet.es).

Technical Director of the Barcelona Dust Forecast Center (http://dust.aemet.es).

### D. ACADEMIC RECORD

1980 – MSc Degree in Physics. Specialisation in Physics of the Earth and the Cosmos. University of Barcelona

### E. PROFESSIONAL RECORD

1980 - State Meteorological Agency of Spain (former National Institute of Meteorology)

1980 - 1986 Meteorological Observer

1986 - 1988 Assistant Meteorologist

1988 - Meteorologist

### F. LANGUAGE SKILLS

Catalan: Native

Spanish: Native

English: Good

French: Good

Russian: Medium

## G. PARTICIPATION IN PROJECTS

| | |
|---|---|
| 2010- | WMO Sand and Dust Storm Warning Advisory and Assessment System (WMO SDS- WAS) |
| 2010. | PROCLAM-I: Surface inversions and low-level jets in complex terrain: Esperimental and numeric study |
| 2009-2010. | EUMETNET GNSS Water Vapour Programme (E-GVAP-II) |
| 2008. | Ibero-American Climate Project |
| 2005-2009. | EUMETNET GPS Water Vapour Programme (E-GVAP) |
| 2002-2005. | Study and parameterisation of the exchanges of momentum, heat and humidity in the Stable Atmospheric Boundary-Layer (INTERCLE) |
| 2001-2007. | COST Action 722: Short-Range Forecasting Methods of Fog, Visibility Low Clouds |
| 1999-2001. | Cooperative Atmosphere-Surface Exchange Study (CASES-99) |
| 1997-2000. | Experimental study and numerical modelling of the physical processes in the Stable Atmospheric Boundary-Layer |
| 1997. | Second Aerosol Characterization Experiment (ACE-2) |
| 1993-1994. | Prediction of frost on highways (Highway Project, PI) |
| 1988-1992. | Support Plan for the Barcelona Olympics (PAMOB'92, PI) |

## H. PEER-REVIEWED PAPERS


Binietoglou, I., S. Basart, L. Alados-Arboledas, V. Amiridis, A. Argyrouli, H. Baars, J. M. Baldasano, D. Balis, L. Belegante, J. A. Bravo-Aranda, P. Burlizzi, V. Carrasco, A. Chaikovsky, A. Comerón, G. D'Amico, M. Filioglou, M. J. Granados-Muñoz, J. L. Guerrero-Rascado, L. Ilic, P. Kokkalis, A. Maurizi, L. Mona, F. Monti, C. Muñoz-Porcar, D. Nicolae, A. Papayannis, G. Pappalardo, G. Pejanovic, S. N. Pereira, M. R. Perrone, A. Pietruczuk, M. Posyniak, F. Rocadenbosch, A. Rodríguez-Gómez, M. Sicard, N. Siomos, A. Szkop, E. Terradellas, A. Tsekeri, A. Vukovic, U. Wandinger and J. Wagner, 2015: *A methodology for investigating dust model performance using synergistic EARLINET/AERONET dust concentration retrievals*, Atmos. Meas. Tech. Discuss., **8**, 3605-3666, doi:10.5194/amtd-8-3605-2015

Camino, C., E. Cuevas, S. Basart, S. Alonso-Pérez, J. M. Baldasano, E. Terradellas, B. Marticorena, S. Rodríguez and A. Berjón, 2015: *An empirical equation to estimate mineral dust concentrations from visibility observations in Northern Africa*, Aeolian Res., **16**, 55-68

Cuevas, E., C. Camino, A. Benedetti, S. Basart, E. Terradellas, J. M. Baldasano, J. J. Morcrette, B. Marticorena, P. Goloub, A. Mortier, A. Berjón, Y. Hernández, M. Gil-Ojeda and M. Schulz, 2015: *The MACC-II 2007–2008 reanalysis: atmospheric dust evaluation and characterization over northern Africa and the Middle East*, Atmos. Chem. Phys., **15**, 3991–4024, doi:10.5194/acp-15-3991-2015

Ferreres, E., M. R. Soler and E. Terradellas, 2013: *Analysis of turbulent exchange and coherent structures in the stable atmospheric boundary layer based on tower observations*, Dyn. Atmos. Oceans **64**, 62-78

Viana, S., E. Terradellas and C. Yagüe, 2010: *Analysis of gravity waves generated at the top of a drainage flow*, J. Atmos. Sci, **67**, 3949-3966

Terradellas, E., and B. Téllez, 2010: *The use of products froms ground-based GNSS observations in meteorological nowcasting*, Adv. Geosci., **26**, 77-82

Viana, S., E. Terradellas, C. Yagüe and G. Maqueda, 2009: *Analysis of the different regimes of atmospheric turbulence observed during a single night*. Nuovo Cimento C, **31**, 723-742.

Terradellas, E., E. Ferreres and R. M. Soler, 2008: *Analysis of turbulence in fog episodes*. Advances in Science and Research, **2**, 31-34..

Tellez, B., T. Cernocky and E. Terradellas, 2008: *Calculation of climatic reference values and their use for automatic outlier detection in meteorological datasets*. Advances in Science and Research, **2**, 1-4.

Terradellas, E. and D. Cano, 2007: *Implementation of a single-column model for fog and low cloud forecasting at Central-Spanish airports*, Pure and Applied Geophysics, **164**, 1327-1345.

Bergot, T., E. Terradellas, J. Cuxart, A. Mira, O. Liechti, M. Mueller and N. W. Nielsen, 2007: *Intercomparison of single-column numerical models for prediction of fog*. Journal of Applied Meteorology and Climatology, **46**, 504-521.

Terradellas, E. and T. Bergot, 2007: *Comparison between two single-column models designed for short-term fog and low clouds forecasting*. Física de la Tierra, **19**, 189-203.

Terradellas, E., R.M. Soler, E. Ferreres and M. Bravo, 2005: *Analysis of oscillations in the stable atmospheric boundary-layer using wavelet methods*. Boundary-Layer Meteorology, **114**, 489-518

Cuxart, J., G. Morales, E. Terradellas and C. Yagüe, 2002: *Study of coherent structures and estimation of the pressure transport terms for the nocturnal stable boundary layer*. Boundary-Layer Meteorology, **105**, 305-328.

Poulos, G.S., W. Blumen, D.C. Fritts, J.K. Lundquist, J. Sun, S.P. Burns, C. Nappo, R. Banta, R. Newsom, J. Cuxart, E. Terradellas, B. Balsley and M. Jensen, 2002: *CASES.99: A comprehensive investigation of the stable nocturnal boundary layer.* Bulletin of the American Meteorological Society, **83**, 555-581.

Terradellas, E., G. Morales, J. Cuxart and C. Yagüe, 2001: *Wavelet methods: application to the study of the stable atmospheric boundary layer under non-stationary conditions*. Dynamics of Atmospheres and Oceans, **34**, 225-244.

Cuxart, J., C. Yagüe, G. Morales, E. Terradellas, J. Orbe, J. Calvo, A. Fernández, R.M. Soler, C. Infante, P. Buenestado, A. Espinalt, H.E. Joergensen, J.M. Rees, J. Vilà, J.M. Redondo, I.R. Cantalapiedra and L. Conangla, 2000: *Stable atmospheric boundary layer experiment in Spain (SABLES 98): A report*. Boundary-Layer Meteorology, **96** (3), 337-370.

**Dr Albert Soret Miravet**

albert.soret@bsc.es

https://www.linkedin.com/in/asoret

Sex Male| Date of birth 03/02/1982 | Nationality Spanish

## WORK EXPERIENCE

February 2007 - present

### Senior researcher. Services group coordinator

Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC-CNS), 29 Jordi Girona Street, Barcelona ,08034, Spain

- Meteorological modelling
- Wind energy assessment
- Air quality management
- Environmental impact assessment
- Emission modelling

Business or sector Scientific research

July 2005- February 2007

### Environmental inspector regarding air quality emissions

ECA, now: Bureau Veritas. Avda Can Fatjó dels Aurons, 9 Parque Empresarial A-7, Edif Palausibaris. Sant Cugat del Valles BARCELONA 8174, Spain

- Industrial emissions
- Environmental impact assessment

Business or sector Testing, Inspection and Certification services

## EDUCATION AND TRAINING

March 2010 – December2014

### PhD in Environmental Engineering

Universitat Politecnica de Catalunya

- Air quality and meteorology
- Air quality modelling as a management tool
- Road traffic management measures
- Industrial emissions

September 2006 – May 2007

### Master's degree in Environmental Engineering

Institut Químic de Sarrià; Universitat Ramon Llull

- Environmental sciences
- Industrial processes

September 2000 – May 2005

### Bachelor’s degree in Chemistry

Universitat Autònoma de Barcelona

- Atmospheric chemistry

## PERSONAL SKILLS

Mother tongue(s) Spanish, Catalan

| Other language(s) | UNDERSTANDING | SPEAKING | WRITING |
|---|---|---|---|

| | Listening | Reading | Spoken interaction | Spoken production | |
|---|---|---|---|---|---|
| English | C1 | C1 | C1 | C1 | C1 |
| | Cambridge English: Advanced (CAE) | | | | |

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user

Common European Framework of Reference for Languages

**Communication skills**

- Good communication skills gained through my experience in international conferences and international project meetings.

**Organisational / managerial skills**

- Good organisational skills gained as technology transfer and studies manager

**Job-related skills**

- ability to work in a team
- ability to work under pressure

**Computer skills**

- good command of air quality and meteorological models: WRF-ARW; CMAQ; HYSPLIT
- good command in Linux environments and C++, Fortran, Grads, Matlab
- good commando of ArcGIS Desktop ®
- good command of R (Statistical computing)

**Other skills**

- diving: advanced open water diver (PADI)

## ADDITIONAL INFORMATION

| | |
|---|---|
| Publications | • Soret, A., Guevara, M., Baldasano, J.M. The potential impacts of electric vehicles on air quality in the urban areas of Barcelona and Madrid (Spain). Atmospheric Environment. 99, 51-63. doi: 10.1016/j.atmosenv.2014.09.048<br>• Baldasano, J.M., Soret, A., Guevara, M., Martínez, F., Gassó, S., 2014. Integrated assessment of air pollution using observations and modelling in Santa Cruz de Tenerife (Canary Islands), Science of The Total Environment 473–474, 576-588.<br>• Bertotti, L., Cavaleri, L., Soret, A., Tolosana-Delgado, R., 2014. Performance of global and regional nested meteorological models. Continental Shelf Research. In Press. doi:10.1016/j.csr.2013.12.013. |
| Conferences | • Soret, A., Torralba, V., Davis, M., Doblas-Reyes, F., Gonzalez-Reviriego, N., 2015. Climate predictions for site selection: a new generation of risk management tools. EWEA Resource Assessment workshop, Helsinki, Findland, 2-3 June 2015.<br>• Soret, A., Guevara, M., Baldasano, J.M., 2014. Air quality impacts of electric vehicles in Barcelona. 9th International Conference on Air Quality - Science and Application, Garmisch-Partenkirchen, Germany, 24-28 March 2014. |
| Projects | • NEWA. New European Wind Atlas project to produce the best database of wind characteristics throughout Europe (2015-2019).<br>• Rethink big: Roadmap for European Technologies in Hardware and Networking for Big Data (2014-2015)<br>• FIELD_AC: Fluxes, Interactions and Environment at the Land-Ocean Boundary Downscaling, Assimilation and Coupling (2010-2012) |
| Honours and awards | • La Caixa: Postgraduate award to course the Master in Environmental Engineering (Institut Químic de Sarrià.) |

# Renata Gimenez Binder

**Place and Date of Birth:** **Barcelona, 14th December 1975**
**Address:** **Sometents 2-20, 3º5ª**
08950 Esplugues del Llobregat (Barcelona)
**Telephone:** **(34) 93 446 44 44 / (34) 626628559**
**E-mail: renata.gimenez@gmail.com**

**Nationality:** **Spanish & German**

KEY SKILLS

| | |
|---|---|
| German, Spanish (and Catalan) | **mother tongue** |
| English **fluent (Proficiency)** | |
| **Italian** | basics |

**Advanced computer skills**
Windows Office, Basic HTML and Content Management systems, search engine optimization.

**WORK HISTORY**

**BARCELONA SUPERCOMPUTING CENTER, Barcelona** (Spain). June 2005 – to date

- **Marketing & Communication Executive** in the Management Dept. - www.bsc.es
  - Events organization and Public Relations
  - Dissemination Work Package leader of European Projects
  - Responsible for the corporate image and promotional material
  - Production of all print and online communications (briefing, design, printing, quality control)
  - Support in all press activities (press releases, press conference, press invitations, etc.)
  - Social media (Facebook, Twitter, Linkedin)
  - Online marketing promotional campaigns (newsletter, search engine optimization, web analysis tools)
  - Outreach and public engagement campaigns

**CAMBRIDGE UNIVERSITY PRESS, Cambridge** (UK). November 2002 – June 2005

- **Web Marketing Executive** in Information Management – www.cambridge.org
  - Project management of ecommerce, catalogue, etc.
  - Responsible for online marketing and e-marketing campaigns
  - Responsible for the navigation and usability/accessibility of 6 portals (intranet/extranets)
  - Responsible of the content management system (Mediasurface/ Rhythmyx)
  - Quality control of all Cambridge websites

**DEUTSCHE BANK S.A.E., Barcelona** (Spain). August 2000 – October 2002

- **Online Communication Specialist** in the E-business Department
  - Definition of the online and offline style guide and web navigation following usability rules
  - Correction of all online Spanish, German and English texts
  - Collaboration with the German E-business Department in Frankfurt, Germany.
  - Responsible for all translations in the web, definition and edition of the customer's newsletters
  - Responsible for the online marketing sections: Homepage, Guided tour, Member-get-member, etc.

- **Web Editor** in the online portal project called "Moneyshelf"
  - Definition of the online and offline style guide
  - Definition of the online screens together with the Product Manager

- Collaboration with the German Moneyshelf project

**MANGO, Punto Fa, S.L., Barcelona** (Spain). February 1999– August 2000

- *Translation Department Manager* ***reporting directly to the Marketing Manager***
  - Responsible for the three department members
  - Translation of the leaflets of all 45 Mango countries and preparation of all presidents' speeches
  - Department Invoicing and relations with other departments and franchises
  - Interpreting all internal conferences such as the showroom with the franchisers and supervisors of all 45 Mango countries

- **German and English Translator** in the Translation Department within the Marketing Department
  - Responsible for the German and English translations into Spanish and corrections
  - Definition of the internal newspaper and support to other department with linguistic doubts
  - Search for new translation agencies and freelance translators
  - Supervision of all translations with the collaboration of supervisors in all Mango countries worldwide

**EUROPEAN SPEECH, ESTUDIS I SERVEIS S. L., Tarragona** (Spain). March 1998 – February 1999

- **Freelance Translator** and **German Teacher** at the Language School
  - Preparing and teaching all German levels (Grund-, Mittel- und Oberstufe) for companies and individuals and translation of all German (commercial, automotive, financial) texts

***EDUCATION***

November 2002- July 2003
**Postgraduate Course** in **Marketing Management** with the Spanish Open University

October 2001 – April 2002
**Postgraduate Course** in **Marketing** at the Universitat Pompeu Fabra in Barcelona, Spain

July 1999
**Official Certification of German/English Translator and Interpreter and German Sword Translator** by the Universidad Pompeu Fabra in Barcelona, Spain

October 1998 – April 1999
**Pedagogical Certificate** by the Universidad de Barcelona

September 1994 – September 1998
**Translation and Interpreter University Degree** by the Universitat Pompeu Fabra, Barcelona (Spain) specialized in German as a first and active language and English as second and passive.

September 1997 - March 1998
**Winter Semester** in the Translation Faculty at the Universität Leipzig (Germany) within the **SÓCRATES** programme

April - July 1995
**Summer Semester** in the Translation and Interpreting Faculty at the Universität des Saarlandes (Germany) within the **ERASMUS** programme

1978 – 1994
German School of Barcelona, Spain. **Abitur** and **Selectividad,** German and Spanish University Entrance Examination